Rico Townsite Soils

VCUP Application

Rico, Colorado

Submitted to:

Colorado Department of Public Health and Environment

Submitted by:

Atlantic Richfield Company
Rico Renaissance, LLC
Rico Properties
Town of Rico
March 19, 2004

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Town of Rico

Prepared by:

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Preface

This Application for participation in the Colorado Voluntary Clean-up Program (VCUP) is being submitted to address concentrations of lead in soil that may pose a potential health risk to residents of the Town of Rico (Town). Areas to be addressed include: 1) existing residential, commercial and mixed use development in Town; and 2) areas within and immediately contiguous to the current Town limits to the south, east and west that are zoned and/or Town-approved as Residential Planned Unit Developments (RPUDs). These areas taken together define the "Site" as generally located on Figure 1 and shown in more detail on Figure 2. Atlantic Richfield Company; Rico Renaissance, LLC; Rico Properties, LLC; and the Town of Rico (collectively, the "Applicants") support this Application as co-applicants. The Town of Rico is participating as a VCUP applicant to provide access to its properties for VCUP activities, and to facilitate and coordinate public participation and access to non-Applicant properties within the Town of Rico for data gathering and cleanup, if required.

All investigations, cleanup activities and document submittals under this VCUP will be the responsibility of and carried out by Atlantic Richfield Company, Rico Renaissance, LLC and Rico Properties, LLC (collectively, the "Rico Work Group") with the support of the Town. The Rico Work Group will fund Colorado Department of Public Health and Environment (CDPHE) oversight activities.

This Application proposes a phased investigation and cleanup to effectively address lead risks at the Site in a thorough and timely manner, with regulatory knowledge and approval. This phased approach is proposed for the following reasons:

- Additional data gathering in Phase I is warranted to evaluate the health risk to the community and to develop specific clean-up actions for CDPHE consideration and approval. Prior soil lead investigations in the Rico area have not been comprehensive in scope and have not targeted the collection of data necessary to support the design and implementation of specific clean-up actions of Site soils. Data from the most recent of these studies, the October 2003 sampling of residential properties by the United States Environmental Protection Agency (U.S. EPA), was recently made available to the Applicants and will be considered as risk assessment or clean-up planning progresses in Phase I.
- Under the proposed phased approach, after further samples are taken, cleanup actions to address potential immediate exposures will proceed during the 2004 construction season under Phase I.
- Comprehensive data from the Phase I studies will then be used to develop and implement any further clean-up actions and related activities that may be needed under Phase II.

The purpose of this Phase I submission is to:

- Provide general application information regarding known environmental conditions.
- Present methods for further sampling and analysis of soils to document the distribution of lead in soils at the Site.
- Identify methods for risk determination and development of a risk-based action level.

- Present a general description of remedial actions planned for the Van Winkle mine site and a limited number of residences where concentrations of lead in soil may justify accelerated action within the 2004 construction season.

Additional documents that will be generated during the VCUP process include:

- Phase I Work Plan and Preliminary Data Report – This document will present an evaluation of the 2003 U.S. EPA soil sampling results (a request has been made to U.S. EPA to provide all additional relevant information, including data validation), a preliminary assessment of the results of the additional sampling and analysis to be performed pursuant to this VCUP Application, and detailed plans for Phase I clean-up of townsite properties identified as potentially posing an immediate health risk (currently proposed as sites with lead concentrations in surface soils greater than or equal to 3,000 milligrams per kilogram [mg/kg] or parts per million [ppm]). In addition, a site-specific plan for remediation of the Van Winkle mine site and other priority clean-up areas identified in consultation with CDPHE will be included.

- Phase I Risk Assessment and Final Data Report – This report will present the results (including data validation) and final evaluation of the Phase I soil sampling and analyses, and the detailed methodology and results of the human health risk assessment. These results will provide the basis for assessing the protectiveness and permanence of Phase I clean-ups, and provide the health risk-based action level(s) for Phase II remediation of lead in soils at additional properties.

- Phase II Work Plan – This document will present the detailed remediation plan for residential and other properties exceeding the applicable action level(s) identified by CDPHE and address, as appropriate, institutional controls (ICs) for future development.

- Completion Report/No Further Action Determination – Upon completion of all clean-up pursuant to this VCUP Application, a final report will be prepared documenting the work performed under both Phase I and Phase II, and compliance with all the relevant requirements of the VCUP Application and the associated work plans and reports.

The Applicants anticipate that Phase I activities will be completed in 2004 and that Phase II activities will be completed in 2005. A schedule of key deliverables and major work elements is presented in Section 4.3 of this Application.

1.0 General Information

1.1 Name and Address of Owner

This Application is submitted by Atlantic Richfield, Rico Renaissance ("RR"), Rico Properties ("RP"), and the Town of Rico (Town). RR, RP and the Town are owners of real property within the Town limits; Atlantic Richfield does not own real property in the Rico area. These entities are collectively referred to in this report as "the Applicants." A map showing property owned by the Applicants, together with existing Town rights of way, properties planned to be dedicated or donated to the Town, and U.S. Forest Service properties planned for acquisition and future development is in preparation and will be submitted to CDPHE with the Phase I Work Plan and Preliminary Data Report.

1.2 Contact Person and Phone Number

Contacts for the Applicants include:

Atlantic Richfield:	Dave McCarthy	406-782-9964, ext. 430
Rico Renaissance:	Ramone Escure	970-728-6116
Rico Properties:	Stan Foster	970-749-7126
Town of Rico:	Eric Heil	970-967-5550

1.3 Location of Property

The Site consists of lands within the present limits of the Town of Rico, Colorado, and those portions of immediately contiguous Residential Planned Unit Developments (RPUDs) to the east, south and west of the Town that are included in the current approved Rico Master Plan. Figure 1, "Rico District Location Map," identifies the general location of the Town of Rico and Figure 2, "Town of Rico Site Boundary Map," shows the area within the current Town boundary and the general location of the portions of the approved RPUDs outside the Town limits that together comprise the Site.

1.4 Type and Source of Contamination

Lead in soils may pose an unacceptable health risk to Town residents. The source of the lead in soils may be attributable to mining/processing activities, lead paint, other anthropogenic sources or high naturally occurring levels of lead.

1.5 Voluntary Clean-Up (VC) or No Action Determination (NAD)

This Application is for a Voluntary Clean-up under Colorado's Voluntary Clean-up and Redevelopment Act.

1.6 Application Organization

The Colorado VCUP requirements and checklist were consulted in the preparation of this Application. Because this Application is for a Site that includes no current related industrial operations, the VCUP checklist is, in some instances, not applicable to the Site. This Application focuses on VCUP requirements that are most relevant to the resolution of issues related to lead in soil within the Site boundaries. For completeness, the VCUP Checklist and additional information to address less relevant checklist items are included in Appendix A, "Colorado VCUP Application Information."

2.0 Environmental Assessment

2.1 Address and Legal Description of Site

This Application for participation in the VCUP is being submitted to address concentrations of lead in soil that may pose a potential health risk to residents of the Town of Rico and in immediately contiguous areas approved for future residential development in the current Rico Master Plan. The Site location includes areas within the Town of Rico boundary and RPUD areas where these extend beyond the current Town limits as shown on Figure 2.

2.2 Operational History

2.2.1 Introduction

The mining-related operations in the area of Rico, Colorado started with the staking of the first mining claim in 1869. Since then a variety of mining-related activities have taken place within and nearby to the Town of Rico. The following sections outline the key historical periods of mining-related activities within the Town area with a focus on identifying the age, location, and nature of specific operations. Important references for this historical information have been (Ransome, 1901) for the early history of operations and (McKnight, 1974) for the later history. Other references are noted in the text where appropriate.

2.2.2 1869-1894

After the first mining claim was staked in 1869 (the Pioneer claim located at the mouth of Silver Creek), there was sporadic surface and near-surface exploration with limited success until high-grade silver ores were discovered in 1879. During this period 9,235 tons or 11 percent (%) of the district's total lead production took place.

The Atlantic Cable shaft was sunk during this period, but it was primarily exploratory in nature. Much of the high-grade silver processing included milling and smelting operations at the Grand View smelter (constructed in 1880) and another smelter at the south end of town (Pasadena) constructed in 1882.

Another important development during this period of Rico's history was the completion of the Rio Grande Southern Railroad into town in 1890. This narrow gauge railroad had significant facilities within town including, a station house, fueling areas, a turnaround spur, a water tower (still standing), and side spurs up Silver Creek and to Newman Hill (Enterprise Mine). With the exception of one standing water tower, the railroad's presence is primarily evidenced today by the old railroad grade which remains as a dirt road and trail along the Dolores River, and widespread scattering of debris, such as cinders and coal, at various places along the river corridor.

2.2.3 1894-1929

Production of metals in Rico continued during this period but lead averaged only 335 tons. The Pro Patria mill was developed in 1902. In addition, a small mill using magnetic separation technology was developed at the Atlantic Cable mine. An aerial tram was used to bring ore down to the Pro Patria mill from the Newman Hill area. The Pro Patria and Atlantic Cable sites are within the Town of Rico. Details of the Pro Patria mill history are included in a prior VCUP application (Columbia Tailings, Pro Patria Tailings, and Silver Swan East Waste Rock Pile Application approved March 4, 1996) (ARCO, 1996a). In general, local processing was minimal during this period as the technology needed to handle the ores satisfactorily was not available.

The Pro Patria became a 250 ton-per-day flotation mill in 1926 and was active between October 1926 and July 1928 (when it was permanently closed); this mill processed most of the ore produced in the district. At other times during this period, ore production was shipped to the Salt Lake area for processing. All major mining areas were active at this time including the Shamrock and Atlantic Cable mines within the Town of Rico. Tailings from the Pro Patria mill are thought to mostly be impounded at the Columbia Tailings site (ARCO, 1996a). Although this was a relatively short period, activity was high and the peak base metal production for the district was reached in 1927 when 4,994 tons of lead was produced. With the Great Depression of 1929, mine operations in the Town of Rico came to an end.

2.2.4 1929-1970

There were not significant mining operations in the Rico townsite during the Great Depression years and the period that followed (1929-1939). Outside the townsite, the Rico Argentine Company built a 135-ton per day flotation mill up Silver Creek in 1939 and production from most mines of the area was processed here in subsequent years. Overall, production from several mines fed the Argentine mill on Silver Creek and 56% (over 47,000 tons) of the lead and 72% (over 59,000 tons) of the zinc production from the district took place during this period.

The Van Winkle shaft, sunk in 1942, provided significant ore to the Argentine mill for several years. This is the only production that took place within the Town of Rico during this period.

The period from 1939 to 1971 was the time of most lead production in the district, and it came to a close in 1971 when the Rico Argentine mines and mill were shutdown. Some efforts to develop commercial mining enterprises did take place later but the time of significant mining activity in the area ended with shutdown of these facilities.

2.2.5 1970-1988

On the west side of Rico, mining by Silver Bell Industries produced some 75,000 tons of sulfide ore from the Santa Cruz mine area from 1970-1975. This ore was shipped to a mill in Ophir, Colorado and not processed in the Rico area. More details of the history of this operation are provided in a prior VCUP application for the Santa Cruz mine site (ARCO, 1996b).

The Anaconda Company entered an Agreement in June 1978 with Rico Argentine Mining Company, a division of Crystal Exploration and Production Company, under which The Anaconda Company obtained exclusive possession of Rico Argentine Mining Company's mineral properties in the Rico vicinity for exploration purposes. The Anaconda Company also acquired an option to purchase such properties under that Agreement. Pursuant to a June 1980 Letter Agreement and an August 1980 Closing Agreement with Crystal Exploration and Production Company, a subsidiary of Crystal Oil Company, The Anaconda Company acquired Rico Argentine Mining Company's surface and mineral properties in the Rico area. Atlantic Richfield Company, a successor to Anaconda, subsequently sold these properties to Rico Development Corporation under a Purchase and Sale Agreement executed in May 1988.

2.2.6 1988-Present

Mining-related activity has been minimal since 1988. In its place, the Town is now experiencing a time of revitalization that accompanies real estate development as a Colorado mountain village near a major ski resort (Telluride). New roads, expansion of the community water system, active zoning, and planning as a residential and recreational center is underway.

2.2.7 Summary and Prior VCUPs in Rico

Throughout Rico's history, mining and related activities have primarily been located nearby but outside the Town of Rico. The principal mining-related operations within the Town of Rico have derived from:

- Early processing of small volumes of silver-rich ores at the Grand View and possibly one other smelter.
- Early surface and near surface exploration at the Shamrock and Atlantic Cable mines where sulfide mineralization was exposed in outcrop (Ransome, 1901).
- Operation of the Pro Patria mill and related facilities such as trams for a short period in the 1920's.
- Production from the Van Winkle mine, primarily in the 1940's.
- Between 1894 and 1938 the Rio Grande Southern Railroad shipped sulfide ore for processing elsewhere, primarily in Utah. The railroad's facilities were mostly located along the river corridor.

The Grand View smelter processed oxidized, silver-rich ores that contained low lead and zinc contents compared to non-oxidized sulfide ores of the district. These ores, produced from mines on NB Hill above elevations of 9,600 feet, were processed in a small blast furnace to separate silver-rich bullion from waste material or slag. Remnants of this slag are still present locally at the surface. Another smelter (Pasadena) was historically located at the south end of town. This smelter, apparently constructed in 1882 and operational for a short time in the 1880's, probably processed silver-rich ores from the Newman Hill area. Surface evidence for its location and nature is not visible today.

Clean-up actions were completed at several sites within the Town of Rico in 1996 pursuant to two prior VCUP applications. One of the prior applications dealt with the Columbia Tailings, Old Pro Patria Mill Tailings, Shamrock Mine Waste Rock Pile and Silver Swan East Waste Rock Pile sites (ARCO, 1996a) by consolidating tailings and waste rock at the Columbia Tailings site. The Columbia Tailings site was then graded to provide runon/runoff control, covered with growth media and revegetated to prevent direct contact with the waste soil/rock, and armored with riprap to protect against flooding of the adjacent Dolores River.

The Grand View Smelter site (ARCO, 1996c) was remediated by relocating the small volume of waste rock present (approximately 100 cubic yards) to the Columbia Tailings site, and then covering with growth media and revegetating the removal area. Minor grading was done locally to maintain the pre-existing runon/runoff drainage slopes/patterns, and an area adjacent to the Dolores River was protected from erosion/flooding by constructing a riprap revetment.

2.3 Current and Proposed Land Use and Zoning

The current range of land use for the Town of Rico is typical for a small Colorado mountain town. Rico is a zoned community with a Master Plan to guide its future development. Land use within the Rico townsite includes residential, commercial, public facility, mixed use, and open space areas. Zoned areas are shown on Figure 3, "Town of Rico Zoning Map." Historical preservation, recreation, and tourist-related developments are important to Rico's future. The outline for longer-term land use is generally described in Figure 4, "Rico District Proposed Master Plan." Community plans place the Grand View smelter site within a commercial/residential zone, and the Atlantic Cable mine headframe area is planned open space committed to historical preservation. The Van Winkle shaft and waste rock area is planned open space committed to historical preservation. Various mining- or railroad-related sites along the Dolores River, such as the Pro Patria and Columbia Tailings sites are planned open space within the Town's projected River Corridor that is set aside for recreational use. The proposed overall land use for the Town of Rico will be similar to current uses, with plans for future expansion of residential and commercial/light industrial development.

2.4 Physical Characteristics

2.4.1 Topography

Rico is located in the high relief southwest part of the San Juan Mountains where very steep to steep mountain slopes, and steep to moderate sloping tributary stream valleys, abruptly descend upon the gently to moderately sloping and relatively narrow Dolores River valley (Figure 2). Many of the steep draws and gulches formed on the hillsides on both sides of the Dolores River and its Silver Creek tributary are snow avalanche chutes. Elevations in the Rico area generally range from over 12,000 feet at the crest of surrounding mountain peaks, such as Telescope Mountain (12,201) and Dolores Mountain (12,112) to 8,700± feet in the Dolores River valley at Rico.

The intersection of Glasgow Avenue (Highway 145) and Mantz Street in the Town of Rico is at about 8,800 feet elevation. Most of present day Rico is built on moderate to low slopes developed where tributaries deposit alluvial fans on the Dolores River flood plain. These low slopes continue to be preferred for development but because of their limited area, new development (particularly residential), is expanding onto steeper slopes surrounding the Town (Figure 2).

2.4.2 Surface Water Bodies and Wastewater Discharge Points

The Dolores River below the Town of Rico has a mean annual historic flow of 132 cubic feet per second (cfs) with a typical seasonal flow range of between 20 and 600 cfs. The annual high flows occur during snowmelt runoff in May and June. The annual low flow period occurs in November through March with January and February having the lowest average monthly flow of 19 and 18 cfs, respectively. The 100-year flood peak is estimated at about 2,700 cfs (Dames and Moore, 1981).

Silver Creek, the principal tributary to the Dolores River in the area, drains through the Town of Rico. The gradient of the relatively narrow cobble and boulder-lined channels is moderate where it passes through Rico. Historic instantaneous measurements of Silver Creek flow below the Argentine tailings ponds range from about 0.06 cfs to 23 cfs. Most annual high flows occur during snowmelt runoff in the spring and early summer months (April-July). Infrequent floods result from high-intensity rainfall during the summer months. The 100-year flood peak flow is estimated at about 525 cfs (Dames and Moore, 1981). In Rico, the channel is locally incised and confined by flood control banks.

2.4.3 Groundwater Monitoring and Supply Wells

The surface waters within the Town of Rico are not used as a water supply source for the Town. Silver Creek, from a diversion point located approximately 1.25 miles above the townsite, is the Town's current source of water (Figure 2). The Town of Rico is in the process of obtaining the approvals necessary to utilize shallow alluvial groundwater in the Dolores River valley north of town for water supply and discontinue use of the Silver Creek Diversion.

There are no known ground water monitoring or supply wells within the Town of Rico. Colorado Division of Water Resources records were searched for all registered wells in the east end of Dolores County. Most of the wells on record are located in the Dunton area within the West Dolores River Basin (Figure 1).

There are three registered supply wells in the Rico area. These are located upstream and north of the town on the west side of the valley north of the townsite. Two of the wells supply water for domestic use and are located one mile upstream of the town. The third well was used by the Colorado Department of Transportation. This well has been abandoned and plugged. There are no known unregistered water wells within the townsite or along the Dolores River. Three small diameter (2 inch) piezometers (perforated PVC pipe) were installed in alluvium on the perimeter of the Columbia Tailings pile in October 1995 to determine the depth to water. These piezometers have since been abandoned. There are no known unregistered water wells within the townsite or along the Dolores River.

Several groundwater samples were taken in the fall of 2002 as part of a Colorado Department of Public Health and Environment (CDPHE, 2003) Brownfields study. These samples were collected at the Dolores County Maintenance Barn site within the Town and all indicated non-detectable levels of lead in groundwater.

2.5 Contaminant Releases

2.5.1 Chemical Nature and Extent

Several previous investigations in the Rico area have included the sampling and analysis of townsite soils for lead, although none have been specifically designed to fully characterize the distribution of lead or to provide the basis for decisions on remedial action. These previous investigations are summarized in Section 2.5.5.

The distribution and concentrations of metals, including lead, in the bedrock and surficial soils in the Town of Rico reflect the influence of the historic hydrothermal system in the area. The bedrock in the Town has the highest overall metal content and the colluvium derived from this bedrock is nearly as high. The principal sources of metals are natural. The townsite is developed on these natural materials and the mining-related impacts such as waste rock and tailings piles are definable. Development of the Town has had a large impact on the original natural surfaces. However, townsite development has not significantly changed the natural metals distribution (ARCO, 1996c).

2.5.2 Groundwater Depth

No existing groundwater monitoring or water supply wells are known to be located within the Town of Rico. Therefore, no data exist to document water table elevations or groundwater movement across the town. Short-term measurement of the piezometers at the Columbia Tailings site noted previously indicated a local groundwater gradient downstream and toward the Dolores River, as would be expected in the shallow alluvial aquifer being monitored. A generally similar pattern of downslope (toward the Dolores River) and downstream groundwater flow would be expected within the alluvial and colluvial deposits underlying much of the Town of Rico.

2.5.3 Groundwater Contamination Potential

This VCUP Application addresses the presence of lead in soils within the Town of Rico. Based on relatively recent data from the Colorado Department of Public Health and Environment (CDPHE, 2003), the potential for impact to groundwater from these soils is judged to be low. Lead values from five groundwater sampling locations in the vicinity of the County "Maintenance Barn" were all reported as non-detects (ND). These groundwater sampling locations were in the same area as four surficial soil sampling sites for which lead values were reported to range from 620 to 4500 ppm), with an average concentration of 2580 ppm. Furthermore, there are no municipal water supply wells within the town.

2.5.4 Hydraulic Tests

No hydraulic tests of aquifers are known to have been performed within the Town of Rico.

2.5.5 Site Soil

Data from five previous studies are available to help define the heavy metal contents of bedrock and surficial materials in the Town of Rico.

Walsh (1995) – Walsh Environmental Scientists and Engineers, Inc. conducted a Phase I and Phase II Environmental Site Assessment (ESA) in and around the Town of Rico that included limited sampling of waste rock piles, mine tailings, and fill material. Forty-eight samples were collected, targeting areas of interest to Rico Renaissance, LLC. Thirteen of the samples were in commercial/residential areas and seven were in locations considered background.

ARCO (1996c) – As part of the VCUP application for the Grand View Smelter, ARCO incorporated data from the PTI Environmental Services sampling performed in 1995. The PTI study included 73 soil sampling locations, 32 of which were residential surface samples, 20 of which were background surface samples, and 20 of which characterized 10 residential sampling locations at depth. One sample was collected from mine waste at the Van Winkle Mine site.

Titan (1996) – Titan contracted with Michael Russ to perform geological and geochemical mapping of soils in the Rico area to characterize metals concentrations in relation to the mineralogy of the source material and historic mining and processing operations. Twenty-four rock outcrops and 22 surficial deposits were sampled as part of this study. The study concluded that concentrations of selected metals (including lead) in surficial deposits are derived predominantly from geologic processes acting on natural sources.

State of Colorado Brownfields (2003) – The Colorado Department of Public Health and Environment (CDPHE) conducted limited groundwater and surface soil sampling as part of

Brownfields assessment fieldwork in late 2002. Four surface soil samples were collected at the Dolores County "Maintenance Barn" site within the Town of Rico. Lead concentrations in these samples ranged from 620 to 4500 ppm and averaged 2580 ppm.

U.S. EPA (2004) – The U.S. EPA sampled soils at numerous properties within the Town of Rico in October 2003. Data from this sampling event were only recently made available and therefore, have not yet been thoroughly reviewed by the Applicants for use in the overall evaluation of the Site. Other field information, and data validation results have been requested from U.S. EPA and will be considered in preparing the Phase I Work Plan.

Sampling locations from the first four studies above are depicted on Figure 5, "Prior Sampling Locations and Risk Assessment Exposure Areas." Figure 6 "October 2003 EPA Sampling Locations" shows the locations and associated soil lead concentrations from the latest sampling (EPA, 2004). Together, these figures present the currently known surface soil lead characterization for the Rico townsite. Additional soil samples are required to fully characterize the townsite surface soils with respect to lead. A summary and analysis of all sampling events will be presented in the Phase I Risk Assessment and Final Data Report, following sampling activities.

2.5.6 Environmental Sampling

As part of the Applicants' Phase I Work Plan and Preliminary Data Report, previous investigation data will be incorporated, as appropriate, to support risk assessment and remedial planning. Additional soil sampling and analyses are proposed to supplement the existing database. The protocol for the additional sampling and analysis is detailed in the Sampling and Analysis Plan (SAP), which is submitted as part of this VCUP Application in Appendix C. The following subsections summarize the key elements of the SAP. Quality assurance procedures, documenting data quality objectives, quality assurance/quality control measures, and field and laboratory standard operating procedures (SOPs) will be submitted to CDPHE for review and approval prior to initiating fieldwork.

2.5.6.1 Soil Sampling and Analysis

This section describes the overall approach and methods to be applied to the sampling of soils from properties within the Site as previously defined. Specifically, this section discusses the investigation boundaries, property types, sampling protocols, and analytical parameters. This information should be viewed as preliminary, as the approach may be modified with CDPHE approval once relevant data from all previous investigations is made available to the Applicants and has been thoroughly reviewed for use in risk determination/remedial planning.

2.5.6.1.1 *Investigation Boundaries*

The investigation of soils will be limited to properties within the Town boundary and portions of RPUD areas immediately contiguous to the east, south and west of the current Town limits. Emphasis will be given to residential, commercial, public and open space (recreational) parcels in the existing developed portions of Town that may present a current unacceptable exposure to lead (see Zone 1 on Figure 7, "Preliminary Delineation of Soil Sampling Zones"). Sampling will also be performed on properties within the Site that are available and/or currently planned for future development (see Zone 2 on Figure 7). The specific location and density of sampling in Zone 2 will be based upon the availability and quality of previous sampling data, the geology/mineralogy of soils, and near-term land use plans.

2.5.6.1.2 *Types of Properties*

The Town of Rico official zoning map (Figure 3) identifies a number of different land uses, each of which presents its own considerations for exposure and abatement that must be considered in formulating a sampling plan. Sampling of any property is subject to obtaining access from the landowner. The categories of currently zoned properties to be sampled include: Residential, Commercial/Historic Commercial, Residential/Commercial Planned Unit Development (RPUD/CPUD)/Mixed Use, and Open Space/Public Facilities. Key considerations for sampling at each of these property types are discussed in the SAP (Appendix C).

2.5.6.1.3 *Soil Sampling Protocol*

Soil sampling protocols applicable to properties in currently developed areas (Zone 1) versus properties in areas of potential future development (Zone 2) and the specific sampling protocols to be applied to each of the property types previously identified are described in the SAP (Appendix C). In summary, surface soil samples in currently developed areas (and at any dispersed developed residential properties that may fall outside the Zone 1 boundaries) will be collected from a depth of 0 to 1 inch at five randomly selected locations at each of up to several sampling sections on each property or lot (whether currently vacant and/or occupied or not). These five samples will be composited into a single sample for analysis. Locations for depth sampling will be randomly selected at an approximate rate of one depth sample per three existing residential/commercial properties sampled. Intervals for depth samples will be 0 to 6 inches and 6 to 12 inches. Additional residential samples will be collected in driveways, gardens, and play areas.

Surface soils on properties in areas of potential future development (Sampling Zone 2) will be sampled at a frequency of approximately one sample per 25 acres. Each sample will be composited from 5 randomly selected sub-samples taken within the approximately 25-acre section.

Additional sampling of potential source material, Open Space/Public Facilities, and Town streets within the Site will be performed relative to the associated exposure potential in accordance with the protocol for one of the other categories discussed here. Additional details regarding this sampling are discussed in the SAP (Appendix C).

2.5.6.1.4 *Bioaccessibility Samples*

As a subset of soils sampled throughout the Town of Rico, twelve surface soil samples specially sieved through a No. 60 screen will be analyzed for *in vitro* bioaccessibility and lead as described in the SAP (Appendix C).

2.5.6.1.5 *Analytical Procedures*

- Lead – Soil samples will be analyzed using laboratory-grade x-ray fluorescence (XRF). A subset of these samples will also be submitted for laboratory analysis using inductively coupled plasma (ICP) to establish a valid correlation between the results of the two methods as described more fully in the SAP (Appendix C).
- *In vitro* Bioaccessibility – The 12 samples selected as described above will be submitted for in vitro bioaccessibility testing according to the methodology described in the SAP (Appendix C). This analysis will be performed on the sieved portions of the samples.

3.0 Applicable Standards/Risk Determination

3.1 Describe Applicable Standards/Guidance

Applicable standards for lead in soil are not available from the State of Colorado. On the federal level, U.S. EPA's (2001) *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (hereafter called the "Soil Screening Guidance") publishes a generic (i.e., not site-specific) screening level of 400 mg/kg for lead in soil. According to the Soil Screening Guidance, soil screening levels (SSLs) should not be considered national cleanup values; and concentrations in soil above the screening level do not automatically trigger a response action. Rather, exceeding a screening level suggests that a further evaluation of the potential risks posed by site contaminants is appropriate to determine the need for a response action (U.S. EPA, 2001).

Health risks associated with lead exposures are assessed by determination of the potential to exceed a concentration of lead in the blood associated with increased potential for adverse health effects. The Center for Disease Control (CDC) and U.S. EPA have adopted 10 micrograms lead per deciliter of blood (μg/dl) as a risk management action level for children based on studies that indicate that exposures resulting in blood lead levels at or above this concentration may present an increased health risk to children (CDC, 1997 and 2002; U.S. EPA, 1998). Agency management decisions seek to limit the risk that exposures will result in blood lead concentrations at or above this level using site-specific risk assessments to ensure the likelihood that such exposures will occur is reduced (U.S. EPA, 1994 and 1998).

Two models have been developed for use in predicting potential blood lead levels in children and adults exposed to lead in soils, and are recommended by U.S. EPA as primary risk assessment tools for establishing risk-based remediation goals at residential and non-residential sites where exposure to soil lead is a concern. A brief discussion of each of these models as it relates to the assessment proposed in this Application is presented in the subsections below.

3.1.1 Model for Establishing Residential Remediation Goals at Soil Lead Exposure Sites

U.S. EPA's Office of Solid Waste and Emergency Response (OSWER) published guidance to promote consistent decision-making at residential lead sites managed under the U.S. EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) (U.S. EPA 1994 and 1998). The OSWER guidance recommends the use of the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children for establishing risk-based remediation goals at residential sites. According to the guidance, the IEUBK model is considered the best tool for predicting the potential lead levels in children exposed to lead in the environment. The risk reduction goal described in the guidance and recommended by U.S. EPA is intended to "...limit exposure to soil lead levels such that a typical (or hypothetical) child or group of similarly exposed children would have an estimated risk of no more than 5% of exceeding a 10 μg/dl blood lead level" (U.S. EPA 1994 and 1998).

The IEUBK model will be used in the assessment proposed herein to determine appropriate remediation goals for residential exposure units identified at the Rico Site.

3.1.2 Model for Establishing Commercial, Industrial, and Recreational Remediation Goals at Soil Lead Exposure Sites

For non-residential exposures to soil lead, U.S. EPA's Technical Review Workgroup (TRW) for lead recommends use of the Adult Lead Methodology (ALM) (U.S. EPA, 2003). The ALM model equations are designed to be protective of a "fetus of a worker who develops a body burden as a result of non-residential exposure to lead." According to the TRW, protection of the fetus is the most health sensitive endpoint for adult workers. This makes remediation goals using the ALM sufficiently protective of male or female adult workers in a non-residential setting. Similar to the IEUBK model for residential exposure, the ALM model equations target cleanup goals that equate to no more than a 5% probability that fetuses exposed to lead would exceed a blood lead of 10 μg/dl (U.S. EPA, 2003).

The ALM model will be used in this assessment to determine appropriate remediation goals for commercial, industrial, and recreational exposure units identified at the Rico Site.

3.2 Describe Current and Future Exposures at the Site

This section describes known information regarding current and future exposures at the Site based on site-specific soil lead data currently available. In addition to existing site soil lead data, it is anticipated that the assessment approaches detailed in this document will also incorporate a validated data set of U.S. EPA's 2003 sampling results (U.S. EPA, 2004) and sampling results obtained as part of the additional sampling proposed in this Application.

3.2.1 Extent of Soils Contamination

Table 1, "Rico Residential and Recreational Soils Data" and Table 2, "Summary of Lead Concentrations in Rico" summarize existing surface soil lead data results from previous investigations conducted at the Site. Data are delineated by designated exposure areas previously identified at the Site and depicted in Figure 5. For comparison, Figure 3 and Figure 4 show official zoning designations currently applicable to the Site and anticipated future zoning based on approved Master Plan Amendments, respectively.

Given the high background levels of lead in soils at Rico (see Table 2), residential soils in North and South Rico were statistically compared in a previous study (ARCO, 1996c) to background concentrations for these areas to determine if the current residential levels were statistically similar to background. The T-test statistic is used to test the equality (or similarity) of the population mean. If two soil sample populations have statistically similar means, then the populations are considered similar at a given statistical significance level. Table 3, "Summary of T-Test Results for Comparison of Lead Concentrations in Soils with Background," presents the results of this earlier comparison, which showed statistical similarity between lead concentrations in the background residential soils and residential exposure areas. This comparison will be updated once the two additional datasets described above are available, and the results will be presented in the Phase II Risk Assessment and Final Data Report.

3.2.2 Maximum Detections of Soils Contamination

Table 2 presents a summary of the mean, 95% upper confidence limit on the mean (UCLM), and the range (min-max) of lead data from a previous study (ARCO, 1996c) for each of the identified exposure areas at Rico. This table will be updated once the two additional datasets described above are available. Due to the highly mineralized nature of the natural soils in the Rico area, it is necessary to consider concentrations in areas affected by historic discharge or redistribution of mine waste source material with background concentrations in unaffected areas. It should be noted that there are different background values for soils with different origins, and in general, the colluvium soils in the main residential areas reflect highly mineralized zones, while the talus on the valley sides (i.e., East and West Valley areas) is much lower in metals. Thus, different background datasets were developed for areas of the town with soils of different origins.

The maximum for lead for the North Rico residential exposure area (3,920 mg/kg) appears based on previous data to be much less than the maximum for lead in the North Rico background samples (9,300 mg/kg). Comparison of 95% UCLM values from these two datasets indicates that lead concentrations for the north residential exposure area are below the background levels for these areas and therefore, represent naturally occurring concentrations.

The maximum for lead in the South Rico residential exposure area (1,500 mg/kg) appears to be slightly greater than the maximum for lead in the South Rico background samples (1,080 mg/kg).

The maximum values for lead (see Table 2) in the East and West Future residential exposure areas (412 and 441 mg/kg, respectively) are low based on the prior data and apparently represent undisturbed naturally occurring concentrations in these areas.

Figure 8, "Range of Lead Concentrations Versus Exposure Areas," presents a graphical display of lead concentrations for each area. With the exception of the River Corridor, lead concentrations for each area fall within the range of North Rico background concentrations of lead. These comparisons based on the earlier study (ARCO, 1996c) suggest that concentrations of lead are naturally occurring and have not been increased by any discharges or redistribution of mine wastes.

3.2.3 Contaminants Compared to Guideline Values

Colorado does not have promulgated state standards for lead in soil. As previously discussed, remediation goals will be determined for residential and non-residential exposure units at the Site using risk-based modeling approaches recommended by U.S. EPA (U.S. EPA, 1994, 1998, and 2003) and described in Section 3.1.

3.2.4 Present and Future Use Exposure Pathways

Land-use is an important consideration in the identification of exposure areas. Based on land-use and surficial geology, six distinct exposure areas were previously identified within Rico (see Figure 5). These areas are: North Rico Residential, South Rico Residential, Future Residential West, Future Residential East, River Corridor, and the Silver Creek Alluvial Fan. With the exception of the River Corridor, all exposure areas are either currently residential or may be designated for future residential use. This includes some areas of the Site that are currently designated as commercial or light industrial (see Figure 3). To ensure the risk-based approaches applied to this Site are conservative and protective of all potential future uses, the potential human exposure pathways evaluated in this Application will be the same for both present and future uses of the Rico Site, and will be based on residential exposure (using the IEUBK model) in all areas except the River Corridor, which will be evaluated based on recreational exposures (using the ALM model). Note that the previously delineated exposure areas will be reviewed and updated if/as appropriate based on current land use and planning.

Exposure to lead can occur by many different pathways and from many different sources. Both the IEUBK and ALM models incorporate inputs to address the contribution of multiple sources or baseline exposures to resultant blood lead predictions. The specific pathways addressed by the risk-based model approaches proposed for this Application are discussed below.

In the IEUBK model, intake rates are estimated for the quantities of lead inhaled or ingested from soil, dust, drinking water, air, and food. The IEUBK model also considers ingestion of lead in paint, but this is typically addressed in terms of its contribution to the measured concentration of lead in soil or estimated in dust. Ingestion of lead via soil, dust, drinking water and food and inhalation via air are the pathways addressed in the IEUBK modeling. Because not all of the lead entering the body through the respiratory or gastrointestinal (GI) tracts is actually absorbed into the systemic circulation of the blood (i.e., bioavailable), the IEUBK model also incorporates differences in the bioavailability of lead from different environmental media.

The ALM model uses site-specific data on soil lead concentrations and includes a variable to represent baseline exposure via an input of "typical blood lead concentration (µg/dl) in adults (i.e., women of child-bearing age) in the absence of exposures to the site that is being assessed" (U.S. EPA 2003). The ALM incorporates intake rates for lead in soil and appropriately considers ingestion as the primary route of exposure to lead.

3.2.5 Areas/Sources of Contamination

The source of the lead in soils may be attributable to mining/processing activities, lead paint, other anthropogenic sources or high naturally occurring levels of lead. Figures 5 and 6 depict known surface soil lead characterization samples collected previously for the Rico townsite.

3.2.6 Contaminant Mobilities

As described previously, available groundwater data from Rico indicates that lead has not migrated from soils to groundwater. Given that lead is not very soluble, the apparent absence of transport via this mechanism is reasonable. There may, however, be some potential for windblown transport of mining and processing materials and wastes, or naturally occurring high lead soils. It is possible that the present distribution of lead in soils reflects, at least in part, the impact of this transport pathway. Additionally, the risk-based approach to determining cleanup levels for the site proposed in this Application relies on two models, IEUBK and ALM, which were developed specifically to determine soil lead cleanup levels protective of all exposure pathways that might be affected by lead in soil (e.g., indoor dust and airborne particulates). Consequently, the mobility of lead within and between environmental media is captured by the models themselves and not addressed further within this Application.

3.3 Risk-Based Analysis of Exposure Pathways

3.3.1 Risk Determination for Lead Exposures

As previously described, lead risks will be evaluated using a pharmacokinetic model to predict blood lead concentrations in children and adults, which may then be compared to blood lead levels associated with adverse health effects as reported in studies of lead exposure in humans to establish appropriate risk-based remedial targets for the Site.

For assessing risks to children, U.S. EPA's IEUBK model is used to predict blood lead concentrations from exposure to lead in the environment for a hypothetical child or population of children (aged 6 months to 7 years) (U.S. EPA, 1994 and 1998). For adults, U.S. EPA's Technical Workgroup for Lead (U.S. EPA, 2003) recommends a methodology for assessing lead exposure risks to adults using a biokinetic slope factor approach incorporated into the ALM model. A discussion of the pharmacokinetic parameters and assumptions required as inputs to both the child and adult lead risk models will be included in the Phase I Risk Assessment and Final Data Report documenting the proposed risk-based evaluation.

4.0 Proposal for Clean-Up

Specific clean-up plans will be incorporated into documents submitted subsequent to this Application as follows:

- Phase I Work Plan and Preliminary Data Report – This document will present an evaluation of the 2003 U.S. EPA soil sampling results (assuming timely receipt of all relevant information including final data validation), a preliminary assessment of the results of the additional sampling and analysis to be performed pursuant to this VCUP Application, and plans for Phase I clean-up of townsite properties identified as potentially posing an immediate health risk. The soil lead concentration currently proposed as presenting an immediate health risk is 3,000 ppm. In addition, a site-specific plan for remediation of the Van Winkle mine site will be included. The Van Winkle mine site and four properties identified by U.S. EPA (2004) as appropriate for clean-up during Phase I are shown on Figure 9. Additional properties, if any, identified for Phase I clean-up by CDPHE will be located on a revised map that will be included in the Phase I Work Plan and Preliminary Data Report.
- Phase I Risk Assessment and Final Data Report – This report will present the results (including data validation) and final evaluation of the Phase I soil sampling and analyses, and the detailed methodology and results of the human health risk assessment. These results will provide the basis for assessing the protectiveness and permanence of Phase I clean-ups, and provide the health risk-based action level(s) to guide Phase II remediation of lead in soils at additional properties.
- Phase II Work Plan – This document will present the detailed remediation plan for properties exceeding one or more specified action levels as determined by the health-based risk assessment and related evaluation and address, as appropriate, institutional controls (ICs) for future development.
- Completion Report/No Further Action Determination – Upon completion of all clean-up pursuant to this VCUP Application, a final report will be prepared documenting the work performed and compliance with all the relevant requirements of the VCUP Application and the associated work plans and reports.

To assure that property owners and residents are well informed of the investigation and cleanup efforts, the following general communication and coordination protocols will be followed by the Rico Work Group and the Town during investigation and cleanup of Rico townsite soils:

- Identification of Property Ownership – Using Town and/or County records, a map will be prepared identifying ownership of all parcels within the Site boundaries for use in planning of sampling and clean-up activities.
- Notification of Property Owners – General information will be provided to all property owners regarding Rico's mining history, lead issues, the role of the Rico Work Group and the Town, the proposed sampling program, possible remedial actions and proposed schedule of significant VCUP activities.
- Access Agreements – Access agreements will be obtained from property owners prior to collection of samples or performance of clean-up activities.
- Notification of Sampling – Property owners will be notified of the estimated date and time of sampling.
- Notification of Results – Soil sampling results will be included in the Phase I Work Plan and Preliminary Data Report. Owners of properties with elevated soil lead levels deemed to pose a potential immediate health risk (currently proposed at 3,000 ppm) will be individually notified of the results for their properties.

- Development of Yard/Lot-Specific Clean-up Activities – Representatives of the Applicants will meet with each affected property owner to discuss specific clean-up actions at their property.
- Public Information Program – The Rico Work Group and the Town will provide regular progress updates to the community and other interested parties.

4.1 Remediation Alternatives

The clean-up methods for lead-impacted soils in Rico will vary depending upon the size and land-use of the affected property, as well as the immediacy of potential health risks posed by lead in surficial soils at the property. Properties within the previously described soil sampling Zone 1 identified as having surface lead concentrations that may present an immediate health risk (currently proposed at 3,000 ppm) will be addressed as part of Phase I during the 2004 construction season. These properties will be identified in cooperation with CDPHE prior to the Applicants' submittal of the Phase I Work Plan and Preliminary Data Report. Figure 9 identifies the location of the Van Winkle mine site property and four properties identified by the U.S. EPA based on their recent sampling (U.S. EPA, 2004) as appropriate for Phase I clean-up.

The following sections describe planned Phase I remediation activities for the Van Winkle mine site property and properties that may pose an immediate health risk, and Phase II remediation of other properties within soil sampling Zone 1 with elevated lead concentrations exceeding the applicable final action level(s) as determined by the health-based risk assessment and related evaluations.

4.1.1 Phase I

Van Winkle Mine Site – This property encompasses approximately 2.5 acres and is the location of the historic Van Winkle head frame and its associated waste rock pile. Surface lead concentrations may exceed 8,000 ppm based on available data. A site-specific plan for the Van Winkle property will be submitted with the Phase I Work Plan and Preliminary Data Report. Given the size of the site and its similarity to other waste rock sites in the area, the clean-up will rely on techniques that prevent human exposure to the existing waste rock, reduce the potential release of dissolved-phase metals, and provide for the long-term stability of the remediated area. Specific measures that will be incorporated into the clean-up plan will be designed to reduce infiltration, runon/runoff, and direct human contact. Waste materials may be consolidated to achieve proper grades and/or to minimize the size of the area to be remediated. It is anticipated that these measures will be similar to those successfully implemented at other tailings and waste rock sites as part of the previous VCUP clean-ups in the Rico area. Lead-contaminated soils removed from the site will be transported to a temporary staging area or permanent consolidation area in the vicinity to be developed as part of Phase I and Phase II activities.

Phase I Remediation of Residential Properties - Prior to the submittal of the Phase I Work Plan and Preliminary Data Report, the Applicants and CDPHE will cooperate to identify residential properties with surficial soils deemed to potentially pose an immediate health risk (currently proposed at 3,000 ppm) for cleanup during the 2004 construction season. A brief, property-specific plan for each such identified property will be submitted with the Phase I Work Plan and Preliminary Data Report. A key criterion of the plans will be the establishment of a minimum of 12 inches of clean soil at each affected property. This criterion will be met through a combination of high-lead soil removal and the placement of clean soil. High concentration lead soils removed from each property will be moved to a temporary staging area or permanent consolidation area in the vicinity. Borrow areas used as a source of clean soils will first be sampled to verify low metals concentrations. Final reclamation of the clean soil surface will depend on the nature of the original surface and cover. It is anticipated that the final surface will either be comprised of erosion resistant "rock mulch" (borrowed as the clean soil backfill), or revegetated consistent with the original conditions at the site. When replacing existing manicured lawn, it is anticipated that sod placement will generally prove most practical. Watering and maintenance following placement will be the responsibility of the homeowner. Areas that were not previously manicured lawns will be replaced with like kind vegetation or "rock mulch". If sod is not practical or consistent with the pre-existing vegetation, natural grass seeding or hydromulching would be employed.

Special consideration will be given to protection of septic systems, propane tanks and lines, other utilities, fences, retaining walls, concrete features (e.g., patios, sidewalks) and sub-surface irrigation systems during all on-site VCUP activities. In order to protect existing utilities, the location of buried public utilities will be shown on a scaled lot map based on locates arranged through the Utility Notification Center of Colorado. The location of private buried utilities will be based on the owner's description and site observations, confirmed as necessary by probing/pitting during excavation. Soil removal will terminate at the drip line of established trees and shrubs to preserve these high value plantings. Should any damage to such features occur in the course of the work, the damaged property will be repaired or replaced in kind at the expense of the Rico Work Group. Also, standard construction controls will be implemented during all excavation and grading operations to control fugitive dust. More detailed guidelines for yard clean-up activities will be included in the Phase I Work Plan and Preliminary Data Report.

4.1.2 Phase II

Other Properties with Elevated Lead Concentrations – Those properties not considered to pose an immediate health risk will be evaluated for remediation based on a health risk assessment to be completed as part of Phase I. The health risk assessment will identify one or more action levels for lead in soils, based upon the exposure scenarios (i.e., residential, commercial/industrial or recreational). The analytical results from the Phase I sampling will be compared to the action levels to identify additional properties within soil sampling Zone 1 that require remediation. For each property that exceeds the appropriate action level, the Phase II Work Plan will include a plan that will establish a criterion of a minimum of 12 inches of clean soil at each property. The Phase II Work Plan will include diagrams of properties to be remediated and descriptions of any measures necessary to assure the long-term integrity of remedial actions. Because these properties do not pose any potential for immediate health risk, remediation activities are proposed to be completed during the 2005 construction season. General guidelines for the clean-up activities will be as described above in Section 4.1.1.

For undeveloped properties in soil sampling Zone 2, soil lead data will not be available on a site by site basis. Rather, it is anticipated that appropriate institutional controls (ICs) will be established for future development if deemed necessary following the sampling and risk assessment.

4.2 Verification and Completion Report

If treatment of contaminated media is part of the recommended remedial alternative, the sampling program associated with the verification of treatment will be described in each subsequent submission that includes a clean-up plan. In the case of removal of high lead soils and replacement with clean soils, it is anticipated that sampling and analysis of the associated borrow areas for lead and measurement of the depths of placed clean soils will be implemented to document attainment of the clean-up goals.

A Completion Report will be submitted upon completion of all cleanup activities identified under the VCUP application. Consistent with the VCUP program requirements, this Completion Report will also serve as a petition for a 'No Further Action Determination'.

4.3 Schedule

The proposed schedule of submittal of key deliverables and of major anticipated elements of work pursuant to implementation of this VCUP Application is as follows:

Item	Date
	2004
Submit *VCUP Application*	February
Receive VCUP Application Approval	April
Public Meeting	April
Obtain Access Agreements	April – May
Soil Lead Sampling	May – July
Phase I Work Plan and Preliminary Data Report	August
Van Winkle Mine Site Clean-up	August – October
Yard Clean-up for Immediate Risk Properties	August – October
Phase I Risk Assessment and Final Data Report	November
	2005
Phase II Work Plan	March
Phase II Yard Clean-up	May – October
Completion Report/No Further Action Determination	November

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List of Tables

TABLE 1
Rico Residential and Recreational Soils Data

RESIDENTIAL SOILS DATA															RECREATIONAL SOILS DATA		
North Rico			South Rico			East Rico			West Rico			Silver Creek Alluvial Fan			River Corridor		
SAMPLE NUMBER	Pb (mg/kg)		SAMPLE NUMBER	Pb (mg/kg)		SAMPLE NUMBER	Pb (mg/kg)		SAMPLE NUMBER	Pb (mg/kg)		SAMPLE NUMBER	Pb (mg/kg)		SAMPLE NUMBER	Pb (mg/kg)	
Colluvium - Disturbed			Alluvial Fan Deposits - Disturbed						Talus/Slope Wash (West) - Undisturbed			Silver Creek Alluvium - Disturbed			Dolores River Corridor		
926	1,630		RS24	1,000		927	67		RSS09	184	J	RS21	3,400		RSS15	424	J
932	1,150		RSS27	677		928	210		RSS12	124	J	RS22	2,000		RSS16	471	J
936	1,920		RSS36	825		BK11w	62		RSS13	78	J	RS23	800		RS12	5,200	
940	1,390		RSS20	791	J	BK10w	108	J	BK07	66					RS19	12,000	
RSS3O	3,920		School lots	650		BK38w	84		BK08	57					RS20	2,000	
RSS3I	893		RS04	160		BK39w	96		BK09	141					RS27	500	
RSS23	851		RS02	1,500		BK01	206		BK10	108	J				RS25	1,200	
RSS24	2,100		RS18	1,400		BK02	412		BK11	64	J				RS26	1,600	
RSSO7	2,230		Lots 17-20	830		BK15	155		BK12	441	J				RS28	3,500	
			RS16	750		BK03	82		RSS14 (2)	115	J				RSS19	6,180	J
			RSS18	364	J	RSS34	306		RSS10 (3)	143	J				RSS11	124	
			RSS17	1,150	J	RSS02	112		RSS22 (3)	380					RSS35	146	
			RSS37	908		RSS03	105								RSS01	346	
			RSS26	675		RSS04	138										
			RSS25	1,000		Group Tract	260										
			RSS28	402		AdaNorth	77										
			Trench2	230		RS01	100										
						RSS06 (1)	240										
N	9		N	17		N	18		N	12		N	3		N	13	
MIN	851		MIN	160		MIN	62		MIN	57		MIN	800		MIN	124	
MAX	3,920		MAX	1,500		MAX	412		MAX	441		MAX	3,400		MAX	12,000	
MEAN	1,790		MEAN	783		MEAN	157		MEAN	158		MEAN	2,070		MEAN	2,590	
GEOMEAN	1,600		GEOMEAN	680		GEOMEAN	134		GEOMEAN	127		GEOMEAN	1,760		GEOMEAN	1,100	
MEDIAN	1,630		MEDIAN	791		MEDIAN	110		MEDIAN	120		MEDIAN	2,000		MEDIAN	1,200	
STDEV	944		STDEV	371		STDEV	97		STDEV	124		STDEV	1,300		STDEV	3,450	
VARIANCE	8.91E+05		VARIANCE	1.37E+05		VARIANCE	9,350		VARIANCE	15,500		VARIANCE	1.69E+06		VARIANCE	1.19E+07	
T-VALUE	1.86		T-VALUE	1.746		T-VALUE	1.74		T-VALUE	1.796		T-VALUE	2.92		T-VALUE	1.782	
95% UCL	2,380		95% UCL	940		95%UCL	196		95%UCL	223		95% UCL	4,260		95% UCLM	4,300	
FREQUENCY	9/9		FREQUENCY	17/17		FREQUENCY	18/18		FREQUENCY	12/12		FREQUENCY	3/3		FREQUENCY	13/13	

U = Analyte not detected at or above detection limit. Value presented is one half the detection limit.
J = Analyte detected above instrument detection limit but below contract required detection limit.
NA = Not analyzed
(1) Sample RSS06 was disturbed by road construction.
(2) Sample RSS14 was disturbed by road construction.
(3) Samples RSS10 and RSS22 are from the Iron Draw Alluvial Fan Deposit.

TABLE 2
Summary of Lead Concentrations in Rico

RICO SOILS	Number of Samples	Lead (mg/kg)
RICO BACKGROUND SOILS		
North Rico Background		
Mean (Range)	43[1]	1540 (13.0-9,300)
95% UCLM		2,490
South Rico Background		
Mean (Range)	3	744 (544-1,080)
95% UCLM		1,240
RICO RESIDENTIAL/RECREATIONAL SOILS		
North Rico Residential		
Mean (Range)	9	1790 (851-3,920)
95% UCLM		2,370
South Rico Residential		
Mean (Range)	17	783 (160 - 1500)
95%UCLM		940
Future Residential-Slope Wash East		
Mean (Range)	18	157 (620-412)
95%UCLM		196
Future Residential-Slope Wash West		
Mean (Range)	12	158 (57.0-441)
95%UCLM		223
Future Residential -Silver Creek Alluvium		
Mean (Range)	3	2070 (800-3400)
95%UCLM		4,260
Recreational - Dolores River Corridor		
Mean (Range)	13	2590 (124-12,000)
95%UCLM		4,300

[1] Sample 943 (49,500 mg/kg) was excluded from this dataset as an outlier concentration.

TABLE 3
Summary of T-Test Results for Comparison of Lead Concentrations in Soils with Background

	T-Test Results	Similar to Background?
RICO NORTH RESIDENTIAL WITH RICO NORTH BACKGROUND		
Lead	PASS	YES
RICO SOUTH RESIDENTIAL WITH RICO SOUTH BACKGROUND		
Lead	PASS	YES

Appendix A

Colorado VCUP Application Information

A-1 – VCUP Checklist

A-2 – Colorado VCUP Application Information

VCUP CHECKLIST CROSS-REFERENCE

Section	I. General Information
1.1	Name and address of owner
1.2	Contact person and phone number
1.3	Location of property
1.4	Type and source of contamination
1.5	Voluntary Clean-up (VC) or No Action Determination (NAD)
2.3	Current Land Use
2.3	Proposed Land Use. Proposed future land use is not covered in a Phase I or II assessment. A voluntary clean-up approval is contingent upon this item.

Section	II. Program Inclusion Questionnaire
Appendix A	Is the applicant the owner of the property for the submitted VC or NAD? In a Phase I assessment, the owner is not always the party preparing the assessment. The Voluntary Clean-up Program requires owner/designated representative to complete the submittal.
Appendix A	Is the property submitted for the VC or NAD the subject of corrective action under orders or agreements issued pursuant to provisions of Part 3 of Article 15 of this Title or the federal RCRA 1976 as amended? Although Phase I assessments review state records for RCRA corrective actions, the Voluntary Clean-up Program requires details of a corrective action for an eligibility determination.
Appendix A	Is the property submitted for the VC or NAD subject to an order issued by or an agreement with the Water Quality Control Division pursuant to Part 6 of Article 8 of this Title? Although Phase I assessments review state records, detail is not discussed. If Water Quality has issued a permit, the applicant is ineligible.
Appendix A	Is the property submitted for the VC or NAD a facility that has or should have a permit or interim status pursuant to Part 3 of Article 15 of this Title for treatment, storage or disposal of hazardous waste? Although Phase I assessments review state records, detail is not discussed. For the Voluntary Clean-up Program, details of permits or interim status are necessary for an eligibility determination. Based on the site specifics of the permitted facility, the applicant may qualify for the program.
Appendix A	Is the property submitted for the VC or NAD subject to the provisions of Part 5 of Article 20 of Title 8 (Underground Storage Tanks) CRS or of Article 18 of this Title (RCRA)? Although Phase I assessments review state records, detail is not discussed. For the Voluntary Clean-up Program details of Underground Storage Tank or RCRA requirements are necessary to make an evaluation. In some cases (e.g., tanks were removed prior to 12/22/88), the applicant may be eligible for the program.
Appendix A	Is the property submitted for the VC or NAD listed or proposed for listing on the National Priorities List of Superfund sites established under the federal act (CERCLA)? Although Phase I assessments review state records, detail is not discussed. For the Voluntary Clean-up Program, details of CERCLA action are necessary to make an evaluation. In some cases, the applicant may not be eligible for the program.

Section	III. Environmental Assessment
Appendix B	Qualified environmental professionals must submit environmental assessments. The applicant must submit documentation, in the form of a statement of qualifications or resume.
2.1	The applicant should provide the address and legal description of the site and a map of appropriate scale identifying the location and size of the property.
2.2	The applicant should describe the operational history of the property in detail, including the most current use of the property.
2.2.1 to 2.2.9	A description of all business/activities that occupy or occupied the site as far back as record/knowledge allows.
2.2.1 to 2.2.9	A brief description of all operations that may have resulted in the release of hazardous substances or petroleum products at the site, both past and present, including the dates activities occurred at the property and dates during which the contaminants were released into the environment. Although Phase I & II assessments may reveal the release of hazardous substances or petroleum products, the exact dates and quantities may not be discussed. For the Voluntary Clean-up Program, the dates of activities, releases, etc., are necessary for an evaluation of eligibility.
Appendix A	A list of all site-specific notifications made as a result of any management activities of hazardous substances conducted at the site, including any and all Environmental Protection Agency ID numbers obtained for management of hazardous substances at the site from either the state or the Environmental Protection Agency. The Phase I assessment will reveal whether a facility has an Environmental Protection Agency ID number, but will not list the notifications made as a result of management activities of hazardous substances. This information is necessary for a Voluntary Clean-up Program evaluation.
Appendix A	A list of all notifications to county emergency response personnel for the storage of reportable quantities of hazardous substances required under Emergency Planning and Community Right-to-Know statutes.
Appendix A	A list of all notifications made to state and/or federal agencies, such as reporting of spills and/or accidental releases, including notifications to the State Oil Inspection Section (OIS) required under 8-20-506 and 507 and 25-18-104 CRS 1989 as amended and 6 CCR 1007-5 subpart 280.50 Part 3 of the OIS regulations, etc.
Appendix A	A list of all known hazardous substances used at the site with volume estimates and discussion of relative toxicities. A Phase I & II assessment does not require such detail, however, the hazardous substances used, volumes and toxicities are important for a VC in the overall evaluation of risk and sampling efforts.
Appendix A	A list of all wastes generated by current activities conducted at the site and manifests for shipment of hazardous wastes off site. A Phase I & II assessment does not require such detail, however, the manifest information is important for a VC evaluation, as in the above item.
Appendix A	A list of all permits obtained from state or federal agencies required as a result of activities conducted at the site. A listing of all permits is beyond a Phase I or II assessment. These are important for the Voluntary Clean-up Program so the Department can evaluate what potential sources may be at the site.
2.3	A brief description of the current land uses, zoning and zoning restrictions of all areas contiguous to the site.

Section	III. Environmental Assessment
2.4	The applicant shall describe the physical characteristics of the site, including a map to scale, and an accompanying narrative showing and describing the following, utilizing historic knowledge as well as current data:
2.4.1	• Topography
2.4.2	• All surface water bodies and waste water discharge points
2.4.3	• Ground water monitoring and supply wells
Appendix A	• Facility process units and loading docks
Appendix A	• Chemical and/or fuel transfer and pumping stations
Appendix A	• Railroad tracks and rail car loading areas
Appendix A	• Spill collection sumps and/or drainage collection areas
Appendix A	• Wastewater treatment units
Appendix A	• Surface and storm water runoff retention ponds and discharge points
Appendix A	• Building drainage or wastewater discharge points
Appendix A	• All above or below ground storage tanks
Appendix A	• Underground or above ground piping
Appendix A	• Air emission control scrubber units
Appendix A	• Water cooling systems or refrigeration units
Appendix A	• Sewer lines
Appendix A	• French drain system
Appendix A	• Water recovery sumps and building foundations
Appendix A	• Surface impoundments
Appendix A	• Waste storage and/or disposal areas/pits, landfills
Appendix A	• Chemical or product storage areas
Appendix A	• Leach fields
Appendix A	• Dry wells or waste disposal sumps
2.5	If ground water contamination exists or the release has the potential to impact ground water, the applicant should provide the following information for areas within a one-half mile radius of the site:

Section	III. Environmental Assessment
2.5.1	• The state engineers office listing of all wells within one-half mile radius of the site, together with a map to scale showing the locations of these wells.
2.5.2	• Documentation of due diligence in verifying the presence or absence of unregistered wells supplying ground water for domestic use, when the potential for such wells is deemed likely as in older residential neighborhoods, or in rural areas.
2.5.1 – 2.5.2	• A statement about each well within the half-mile radius of the site, stating whether the well is used as a water supply well or ground water monitoring well.
2.5.1 – 2.5.2	• Lithologic logs for all on-site wells; copies of field log notes may be appropriate.
2.5.1 – 2.5.2	• Well construction diagrams for all on-site wells showing screened interval, casing type and construction details including gravel pack, interval, bentonite seal thickness and cemented interval.
2.5.3	• Description of the current and proposed use of on-site ground water in sufficient detail to evaluate human health and environmental risk pathways. In addition, the applicant will provide a discussion of any state and/or local laws that restrict the use of onsite ground water.
2.6	The applicant should provide information concerning the nature and extent of any contamination and releases of hazardous substances or petroleum products that have occurred at the site, including but not limited to:
2.6.1	• Identification of the chemical nature and extent, both onsite and offsite, of contamination that has been released into soil, ground water or surface water at the property, and/or releases of substances from each of the source areas identified, including estimated volumes and concentrations of substances discharged at each area, discharge point, or leakage point as per Section 25.16.308(2)(b). Although Phase II assessments identify the nature of contamination, the extent is not always fully defined. For Voluntary Clean-up Program purposes, the source, nature, extent and estimated volumes of the release are important in the overall evaluation of risk and eligibility.
2.6.2	• A map to scale showing the depth to ground water across the site, direction and rate of ground water movement across the site using a minimum of three measuring points.
2.6.3	• A discussion of all hydraulic tests performed at the site to characterize the hydrogeologic properties of any aquifers onsite and in the area.
2.6.4	• All reports and/or correspondence, which detail site soil, ground water and/or surface water conditions at the site, including analytical laboratory reports for all samples and analyses.

Section	III. Environmental Assessment
2.6.5	• A discussion of how all environmental samples were collected, including rationale involved in sampling locations, parameters and methodology, a description of sampling locations, sampling methodology and analytical methodology and information on well construction details and lithologic logs. All sample analyses performed and presented as part of the environmental assessment should be appropriate and sufficient to fully characterize all constituents of all contamination that may have impacted soil, air, surface water and/or ground water on the property. The applicant should use Environmental Protection Agency approved analytical methods when characterizing the soil, air, surface water and/or ground water.

Section	IV. Applicable Standards/Risk Determination
3.1	The applicant should provide a description of any applicable standards/guidance (federal, state, or other) establishing acceptable concentrations of constituents in soils, surface water, or ground water, for the proposed land use. Although a Phase II assessment evaluates applicable regulations for the current land use, it does not cover the proposed land use that may be different (e.g., the current land use is industrial and the proposed land use is residential, which likely has more conservative levels for contaminant concentrations).
3.2	The applicant should provide a description of the human and environmental exposure to contamination at the site based on the property's current use and any future use proposed by the property owner, including:
3.2.1	• A table or list for site contaminants indicating which media are contaminated and the estimated vertical and areal extent of contamination in each medium.
3.2.2	• A table or list of site contaminants, indicating the maximum concentrations of each contaminant detected onsite in the area where contaminant was discharged to the environment, and/or where the worst effects of the discharge are believed to exist. A Phase II assessment will evaluate the extent of site contaminants, not the maximum point or worst effects. The Voluntary Clean-up Program requests this item so that an understanding of the source and nature of the contaminants can be made as it relates to risk.
3.2.3	• A table or list for site contaminants indicating whether the contaminant has a promulgated state standard, the promulgated standard and the medium the standard applies to. A Phase II assessment will not necessarily compare the site contaminants with state standards. This is important to evaluate whether the remedy will meet risk-based clean-up objectives.
3.2.4	• A description and list of potential human and/or environmental exposure pathways pertinent to the present use of the property. A risk determination is not usually completed as part of a Phase II assessment; the VC will use risk as part of the overall evaluation.
3.2.4	• A description and list of potential human and/or environmental exposure pathways pertinent to the future use of the property. (A risk determination is not usually completed as part of a Phase II assessment; the Voluntary Clean-up Program will use risk as noted above. Phase II assessments also do not evaluate future use of the property.)

Section	IV. Applicable Standards/Risk Determination
3.2.5	• A list and map defining all source areas, areas of contamination or contaminant discharge areas. Phase II assessments do not always show source areas. The Voluntary Clean-up Program requires that these areas be defined to indicate the proximity of contaminant with respect to receptors and sampling efforts.
3.2.6	• A discussion of contaminant mobilities, including estimates of contaminants to be transported by wind, volatilization, or dissolution in water. For those contaminants that are determined to be mobile and have the potential to migrate and contaminate the underlying ground water resources, the applicant should also evaluate the leach ability/mobility of the contaminants. This evaluation should consider, but not be limited to the following: leachability/mobility of the contamination, health-based ground water standards for the contamination; geological characteristics of the vadose zone that would enhance or restrict contaminant migration to ground water, including but not limited to grain size, fractures and carbon content; and depth to ground water. This evaluation, and any supporting documentation, should be included in the plan submitted. A Phase II assessment usually does not include a risk determination. However, the Voluntary Clean-up Program will evaluate the risk involved with the proposed clean-up in order to evaluate the application.
3.3	The applicant should then provide, using the information contained in the application, a risk-based analysis of all exposure pathways, which details how the proposed remediation will obtain acceptable risk levels. A Phase II assessment usually does not include a risk analysis, however, the Voluntary Clean-up Program requires this analysis to show that the remediation proposal will attain an acceptable risk or break pathways.
4.0	The Voluntary Clean-up Program includes remediation whereas a Phase I or II assessment does not. Usually remediation is considered a Phase III assessment. The following are the requirements for the clean-up proposal.
4.1	• A detailed description of the remediation alternative, or alternatives selected, which will be used to remove or stabilize contamination released into the environment or threatened to be released into the environment
Future Submittal	• A map identifying areas to be remediated, the area where the remediation system will be located if it differs from the contaminated areas, the locations of confirmation samples, the locations of monitoring wells, areas where contaminated media will temporarily be stores/staged and areas where contamination will not be remediated.
Future Submittal	• Remediation system design diagrams showing how the system will be constructed in the field.
Future Submittal	• A remediation system operation and maintenance plan that describes, at a minimum, how the system will be operated to ensure that it functions as designed without interruptions and a sampling program that will be used to monitor its effectiveness in achieving the desired goal.
Future Submittal	• The plan should describe the sampling program that will be used to verify that treatment of the contaminated media has resulted in attainment of the proposed clean-up goals.

Section	IV. Applicable Standards/Risk Determination
Future Submittal	• The plan should include a schedule of implementation
Future Submittal	The clean-up completion report is necessary to demonstrate that the remediation was completed according to the application. Again, since remediation is involved, the report is beyond the scope of a Phase I or II assessment. The following items should be included in the completion report.
Future Submittal	• A final list of all site contaminants, along with the remaining concentrations, and any deviations from the original plan.
Future Submittal	• A final list defining which media are contaminated and the estimated vertical and areal extent of contamination to each medium.
Future Submittal	• A final list and map defining all source areas, areas of contamination or contaminant discharge areas.
Future Submittal	Soil Contamination: Remediation by Excavation Only:
Future Submittal	• One confirmation sample per 500 ft_2 as measured at the base on the excavation OR two confirmatory samples, whichever method results in the collection of the most samples.
Future Submittal	• One composite sample from each wall of the excavation. In excavations of an irregular shape, one composite sample for every 100 lineal feet of wall. For excavations grater than 5000 ft_2, preparation of a grid for randomization of sampling.
Future Submittal	• Explanation of the sampling method in the narrative as well as any modifications to 1 and 2 above used to better characterize the remedial efforts.
Future Submittal	• If contamination is to be left in place, an additional sample should be collected from the area of the worst contamination, as verified or with a field-sampling device.
Future Submittal	• Depth of samples collected
Future Submittal	• Provision of waste disposal manifests
Not Applicable	In-Situ Soil Remediation
Not Applicable	• Completion of a minimum of two soil borings, with at least one completed in the area identified in the site assessment as the area of highest contamination. For larger areas of contamination, one boring per 10,000 ft_2 of plume area.
Not Applicable	• Completion of the borings should employ a field-screening device and borings should be logged.
Not Applicable	• Soil sample submitted for analysis from each boring would be the sample with the highest field screening or one located at the ground water interface for each boring.
Not Applicable	Ground Water Remediation
Not Applicable	• Field testing should include aquifer and contaminant characteristics such as gradient, partition coefficients, original contaminant levels, etc.
Not Applicable	• At each regular monitoring event, a map showing ground water flow direction, depth to ground water and sampling locations

Section	IV. Applicable Standards/Risk Determination
Not Applicable	• Tabular presentation of data collected
Future Submittal	Summary of Voluntary Clean-up Program participation
Future Submittal	Summary of field activities, remedial activities, any deviations from original plans
Future Submittal	Pertinent figures and drawings of remedial system
Future Submittal	Conclusions made after remedial activities are completed

SECTION II

Program Inclusion Questionnaire

- *Is the applicant the owner of the property for the submitted VCUP?*

  RR, RP and the Town of Rico are owners of real property within the Site limits; Atlantic Richfield does not own real property in the Rico area.

- *Is the property submitted for the VC the subject of corrective action under orders or agreements issued pursuant to provisions of Part 3 of Article 15 of this Title or the federal RCRA 1976 as amended?*

  No.

- *Is the property submitted for the VC subject to an order issued by or an agreement with the Water Quality Control Division pursuant to Part 6 of Article 8 of the Title?*

  No.

- *Is the property submitted for the VC that has or should have a permit or interim status pursuant to Part 3 of Article 15 of this Title for treatment, storage, or disposal of hazardous waste?*

  No.

- *Is the property submitted for the VC subject to the provisions of Part 5 of Article 20 of Title 8 (Underground Storage Tanks) CRS or of Article 18 of this Titles (RCRA)?*

  No.

- *Is the property submitted for the VC listed or proposed for listing on the National Priorities List of Superfund sites established under the federal act (CERCLA)?*

  No.

SECTION III

Site Specific Notifications

- *A list of all site-specific notifications made as a result of any management activities of hazardous substances conducted at the site, including any and all Environmental Protection Agency ID numbers obtained for management of hazardous substances at the site from either the state or the Environmental Protection Agency.*

No such activities have been conducted by the Applicants relative to potential sources of lead in soil in the Town of Rico

County Emergency Response Notifications

- *A list of all notifications made to county emergency response personnel for the storage of reportable quantities of hazardous substances required under Emergency Planning and Community Right-to-Know statutes.*

No such notifications have been made by the Applicants relative to possible sources of lead in soil in the Town of Rico.

State/Federal Notification of Spills or Releases

- *A list of all notifications made to state and/or federal agencies, such as reporting of spills and/or accidental releases, including notifications to the State Oil Inspections Section (OIS) required under 8-20-506 and 507 and 25-18-104 CRS 1989 as amended and 6 CCR 1007-5 subpart 280.50 Part 3 of the OIS regulations, etc.*

No such notifications have been made by the Applicants relative to possible sources of lead in soil in the Town of Rico

Hazardous Substances

- *A list of all known hazardous substances used at the site with volume estimates and discussion of relative toxicities.*

There is no current use of hazardous substances known to the Applicants

Generated Wastes

- *A list of all wastes generated by current activities conducted at the site and manifests for shipment of hazardous wastes off site.*

There are no current activities generating wastes at the site related to lead.

State/Federal Permits

- *A list of all permits obtained from state or federal agencies required as a result of activities conducted at the site.*

Due to the historical nature of past mining activities, no state or federal permits have been required related to mining and processing activities that occurred in and around the Town of Rico.

Facility Process Units and Loading Docks

Not applicable to this Rico Townsite Lead VCUP application.

Chemical and/or Fuel Transfer and Pumping Stations

Not applicable to this Rico Townsite Lead VCUP application

Railroad Tracks and Rail Car Loading Areas

There are no railroad tracks within the Town of Rico.

Spill Collection Sumps and/or Drainage Collection Areas

Drainage collection in the Town of Rico has not been documented. Overland flow is toward the Dolores River and Silver Creek, both of which flow continuously year round.

Wastewater Treatment Units

Currently, no centralized waste water treatment is available in Rico and individual disposal systems (septic/leach field) are used to treat waste water. Approximately 25% of water users do not have an individual sewage disposal system that meets state guidelines (i.e. cesspools or no system at all). The Town requires compliance with the state Individual Sewage Disposal Act for all new development. Town has prepared a 201 Waste Water Treatment Study, a Preliminary Engineering Report for centralized waste water treatment, and various financing applications for state and federal funding. In November of 2000 the Rico voters approved a 3.939 property tax increase to be dedicated for the construction, design and operation of a wastewater treatment system. Federal grant money for construction has been obtained.

Surface and Storm Water Runoff Retention Ponds and Discharge Points

No retention ponds exist within the Town of Rico.

Building Drainage or Wastewater Discharge Points

Information is not available regarding building drainage. There is no centralized wastewater treatment in the Town of Rico, therefore there is no centralized wastewater discharge point.

All Above or Below Ground Storage Tanks

Storage tanks are not relevant to the soil lead VCUP.

Underground or Above Ground Piping

The only known underground or above ground piping would be associated with known tanks and would be localized to the immediate vicinity of the tank system.

Air Emission Control Scrubber Units

No air emission control scrubber units exist within the Town of Rico

Water Cooling Systems or Refrigeration Units

The Town of Rico has no water cooling systems or refrigeration units that would affect the presence of lead in soil.

Sewer Lines

The Town of Rico does not presently have a centralized sewer system. Future plans include the construction of such a system, however.

French Drain System

No French drain systems are known to exist in the Town of Rico.

Water Recovery Sumps and Building Foundations

No water recovery sumps or building foundation drains are known to exist that would affect the presence or distribution of lead in soils in the Town of Rico.

Surface Impoundments

No surface impoundments exist within the Town of Rico.

Waste Storage and/or Disposal Areas/Pits, Landfills

Within the Town of Rico boundaries, there are several mine sites that have been addressed under separate VCUP applications, including the Columbia/Old Pro Patria mill tailings, Silver Swan mine, Grand View Smelter, and Santa Cruz Mine.

Chemical or Product Storage Areas

Other than fuel storage, no significant chemical or product storage areas are known to be present in the Town of Rico.

Leach Fields

In addition to leach fields associated with sanitary septic systems, a septic tank and leach line have been identified at the Assay Building in Rico. This building is located on the east side of Glasgow Avenue, north of the Burley and theater buildings. This building was previously a laboratory used to determine the mineral content of ores. Wastewater generated at the Assay Building was discharged to an individual septic system.

Dry Wells or Waste Disposal Sumps

The Applicants are not aware of any dry wells or waste disposal sumps that would affect lead in soils in the Town of Rico.

Registered Wells

- *The state engineers office listing of all wells within one-half mile radius of the site, together with a map to scale showing the locations of these wells*
- *A statement about each well within the half-mile radius of the site, stating whether the well is used as a water supply well or ground water monitoring well*
- *Lithologic logs for all on-site wells; copies of field log notes may be appropriate*
- *Well construction diagrams for all on-site wells showing screened interval, casing type and construction details including gravel pack, interval, bentonite seal thickness and cemented interval.*

Several previous investigations in the Rico area have included the sampling and analysis of town soils for lead, although none have been specifically designed to fully characterize the distribution of lead or to provide the basis for decisions on remedial action.

The distribution and concentrations of metals, including lead, in the bedrock and surficial soils in the Town of Rico reflect the influence of the historic hydrothermal system in the area. The bedrock in the town has the highest overall metal content and the colluvium derived from this bedrock is nearly as high. The principal sources of metals are natural. The town is developed on these natural materials and the mining-related impacts such as waste rock and tailings piles, are definable. Development of the town has had a large impact on the original natural surfaces. However, town development has not significantly changed the natural metal distribution (ARCO, 1996).

Unregistered Wells

- *Documentation of due diligence in verifying the presence or absence of unregistered wells supplying ground water for domestic use, when the potential for such wells is deemed likely as in older residential neighborhoods, or in rural areas*

No information is known or available on unregistered wells within the Town of Rico.

Groundwater Use

- *Description of the current and proposed use of on-site ground water in sufficient detail to evaluate human health and environmental risk pathways. In addition, the applicant will provide a discussion of any state and/or local laws that restrict the use of onsite ground water.*

Groundwater use within the Town of Rico is not restricted. There is no current or proposed use of ground water in the Town of Rico, therefore this pathway is not considered further in this application.

Appendix B

Qualifications of Environmental Professionals

Qualification of Environmental Professionals

- *Qualified environmental professionals must submit environmental assessments. The applicant must submit documentation, in the form of a statement of qualifications or resume.*

The environmental assessment, applicable standards/risk determination and voluntary cleanup plan have been prepared by a qualified team of environmental, risk assessment, and engineering professionals. Short Elliott Hendrickson Inc.® (SEH) is the lead firm for characterization and environmental engineering and Integral Consulting, Inc. is the lead firm for the risk assessment in this application. The qualifications of the lead professionals from these and other consulting firms who contributed to this application are included in this appendix.

Douglas J. Bach, PE
Senior Professional Engineer

Education

Master of Science
Environmental Engineering
University of Michigan (1984)

Bachelor of Science
Atmospheric and Ocean Science and Natural Resources
University of Michigan (1981)

Professional Registration

Wisconsin Professional Engineer

New Jersey Professional Engineer

OSHA 40-hour Health and Safety Training in Hazardous Waste Operations

Professional Associations

American Society of Civil Engineers (ASCE)

Society of American Military Engineers (SAME)

General Background

Project Manager with 20 years experience in engineering, construction, and environmental management. Proven success leading milti-disciplinary teams of professionals engaged in engineering and business challenges. Technical fields of experience include environmental site remediation, wastewater treatment, facility construction, regulatory compliance, and property assessments. Adept at resolving controversial issues among diverse stakeholders, including industry representatives, lawyers, regulators, citizen groups, municipalities, and government agencies.

Experience

Experience prior to joining SEH:

Wauleco Former Wood Treating Facility – Wausau, Wisconsin. Project Manager for one of the largest and most successful groundwater remediation projects in Wisconsin. Site activities for this multi-million dollar project at a former window manufacturer included recovery of significant quantities of free product (over 7,000 gallons/month) and operation of a biological treatment system to degrade pentachlorophenol (PCP) with minimal generation of hazardous waste. Dramatically reduced site operation and maintenance costs through changes in staff utilization, the use of on-site analytical procedures, upgrading of instrumentation and controls, and treatment system redesign. Successfully negotiated with municipal officials to avoid potential lawsuit and establish ongoing permit conditions. Worked closely with clients outside counsel to develop near-term and long-term site strategy.

Refuse Hideaway Landfill Superfund Site – Middleton, Wisconsin. Project Manager for a precedent setting remediation strategy at a closed landfill site in Wisconsin where groundwater had been contaminated with chlorinated organic compounds. Assisted the Potentially Responsible Party Group (PRPs) to obtain an Explanation of Significant Difference, which modified the remedy to avoid construction of a groundwater extraction system. Documented the effectiveness of previous source control measures to demonstrate the biologically mediated reduction of chlorinated organic compounds. The successful implementation of this strategy saved the PRPs $2.7 million.

Hagen Farm Superfund Site – Stoughton, Wisconsin. - Managed the remediation of soil and groundwater at a former disposal site regulated under Superfund. Remediation included biological treatment of groundwater and bioventing of soils, both contaminated with tetrahydrofuran (THF). Directed the start-up and calibration of an innovative fixed film bioreactor treatment system. Documented the relative importance of natural attenuation processes at the site, which allowed shutdown of the active groundwater remediation seven years earlier than projected, saving the client approximately $1 million.

Multiple Projects, Case Corporation – Racine, Wisconsin - Managed numerous projects important to Case's environmental management program. Projects included pre-acquisition due diligence environmental audits of numerous manufacturing facilities in Europe, Asia, and the US; wastewater treatability assessments; groundwater remediation; and the decommissioning/ decontamination of a closed manufacturing facility.

Mobil Oil Corporation – Midwest Facilities. Managed several staff in several offices involved in the investigation and remediation of multiple retail petroleum storage tank sites and bulk petroleum distribution facilities. The diverse nature of the sites required the use of numerous investigative techniques, remediation technologies and regulatory compliance strategies.

Crab Orchard National Wildlife Refuge – Marion, Illinois. Served as Task Order Manager for $4.3 million Remedial Design and Remedial Action at the Explosives/Munitions Manufacturing Area (EMMA) Operable Unit (OU). The Task Order was performed under the U.S. Army Corps of Engineers (USACE) - Louisville District, Total Environmental Restoration Contract (TERC), and included the design, characterization, and remediation of contaminated soils at several World War II era munitions disposal areas. The remedy included removal of unexploded ordnance, excavation of high-level explosive soils, installation of a soil cover, and restoration of vegetation. Negotiated a flexible, integrated approach with the U.S. Fish and Wildlife Service for design and construction that allowed remediation to begin one year ahead of schedule. The project was completed on budget, despite a three-fold expansion of contaminated soil volume.

Joliet Army Ammunition Plant – Joliet, Illinois. Task Order Manager for a TERC project with an annual budget of $6 million. Oversaw a staff of eight professionals and construction superintendents performing the on-site bioremediation of explosives contaminated soils at this former TNT manufacturing facility. The bioremediation operation is the world's largest for the treatment of TNT. The site is in the process of being transferred from the Army to other governmental entities and private developers for civilian use. Assisted on-site Army representatives in satisfying the demands of stakeholders accepting transferred lands, including the U.S. Forest Service and private developers. Developed a strategy to maintain the targeted throughput of contaminated soils in the bioremediation process, despite encountering high concentrations of DNT, which is more difficult to treat and threatened to slow site operations.

Gloria Chojnacki, CHMM
Senior Environmental Scientist

Education

Master of Science
Environmental and Public Health
University of Wisconsin-Eau Claire (1992)

Bachelor of Science
Medical Technology
University of Wisconsin-Milwaukee (1974)

Professional Registration/ Certification

Certified Hazardous Materials Manager

40-Hour HAZWOPER, Certified

Professional Associations

Federation of Environmental Technologists

Air and Waste Management Association

Institute of Hazard Materials Management

General Background

Senior scientist responsible for RCRA and CERCLA site investigations, remediation and closure plans, and bioremediation and treatability studies for industrial sites. Gloria also functions as a resource for regulatory compliance issues, risk based corrective action and site closure, Human Health Risk Assessment (HHRA), risk management plans, and environmental management system design. Additional experience includes the preparation of air quality operating permits (including Title V and state permits), annual inventory emission reports, and mass balance evaluations. Gloria has also developed a comprehensive company Health and Safety Program for the Waste Management service area including site specific Health and Safety Plans.

Experience also includes project and task management of a wide variety of environmental projects. Technical responsibilities include all phases of due diligence environmental site assessments and audits including regulatory agency database searches and collecting, interpreting, and reporting related data. Responsibilities also include mobile source noise evaluation and modeling using the FHWA Traffic Noise Model and air emission assessment.

Experience

Wisconsin State Lead Lakefront Property Environmental Repair Fund Project – Ashland, Wisconsin. Performed a CERCLA level HHRA and historical review to identify past and present potential sources of on-site contaminants. Researched potential wood treating and manufactured gas processes that may have been used on-site. Prepared site specific Site Health and Safety Plan.

Wisconsin State Lead Environmental Repair Fund Project, Newton Creek – Superior, Wisconsin. Performed a HHRA on select segments of a creek system that extends from the process water outfall of an oil refinery. The HHRA was conducted to identify past and present risk associated with the groundwater, surface water, floodplain, overflow area, and wetlands associated with the creek system.

Confidential Marine Facility – Superior, Wisconsin. RCRA Site Investigation and Closure Plan for fourteen hazardous waste areas of concern. Included were a historical review, waste handling and disposal practices review, gathering, interpretation and reporting of investigation data, and site health and safety responsibilities.

Confidential Client – Western Wisconsin. Managed the RCRA closure of a chromated copper arsenate (CCA) wood treatment facility. Tasks included defining the regulatory status of a former and current drip pad, defining closure options for the facility and impacted soils, determining the timeframe of historical contamination for correct management of soils, and developing an investigation work plan, and a detailed closure plan for the existing facility.

Confidential Client – Western Wisconsin. Assisted in the proper classification of wood ash from facility boiler. WDNR initially classified the waste as hazardous based on isolated grab samples. Assisted in developing a statistically sound sampling strategy and analytical methods to properly classify material as a solid waste.

Confidential Plastics Manufacturer – Frederic, Wisconsin. Provided input to a RCRA remedial investigation, recommended remedial action, and closure plan.

Dahlberg Light & Power – Solon Springs, Wisconsin. Hazardous waste stockpile management and remediation/closure plan and feasibility study for treatment alternatives. Permitting needs evaluated for selected treatment alternative and preparation of required on-site variance for treatment of a listed hazardous waste.

Jackson County Sanitary Landfill – Black River Falls, Wisconsin. Provided input to the design of a bioremediation facility for treatment of petroleum contaminated soils. Was responsible for the ongoing treatment/supervision of required regulatory monitoring, reporting, and recordkeeping activities. Provided input and oversight for proper regulatory closure of facility.

Remedial Investigation – Albany, Wisconsin. Assisted in design and management of bioremediation pile for treatment of petroleum contaminated soil. Was responsible for monitoring, recordkeeping, and closure of the project.

Risk Management Program (RMP)/Process Safety Management Program (PSM). Developed a comprehensive RMP and/or PSM program in compliance with USEPAs Chemical Accident Prevention Provisions and OSHA's PSM Rule. Elements included a Hazard Assessment, Prevention Program, and an Emergency Response Plan in the following projects:

- **Water Treatment Plant – Burnsville, Minnesota**. Chemicals of concern include chlorine.
- **Water Treatment Plants – Coon Rapids, Minnesota.** Chemicals of concern include chlorine and anhydrous sulfur dioxide.
- **Wastewater Treatment Plant – Litchfield, Minnesota.** Chemical of concern include chlorine.

Best Management Practice Program. Developed a BMP Program for the proactive management of propane to correspond to the USEPA's RMP Program. Elements included a Hazard Assessment and Offsite Consequences Evaluation, Prevention Program, and an Emergency Response Program for the following facilities:

- **Waupaca Foundry, Inc. – Waupaca, Wisconsin.**
- **Grede Foundries, Inc. – Reedsburg, Wisconsin.**

Confidential Printing Company – Waseca, Minnesota. Evaluation of potential liabilities associated with disposal of specific solid wastes from this facility. Assessment of the solid waste source separation process, incineration, and ultimate disposal of the ash in a monofill landfill cell along with potential liabilities associated with neighboring properties and potential receptors were included in the evaluation.

St. Croix of Park Falls, Ltd. – Park Falls, Wisconsin. Evaluated requirements and responsibilities for Form R, SARA Title III, Section 313 reporting. Submitted Wisconsin Annual Emissions Inventory reports. Evaluated status of facility's Air Emission Operating Permit.

Dana Transport – Hammond, Indiana. Prepared Annual Emission Statement. Reviewed facility processes and emission points in order to evaluate appropriateness of existing permit. Reorganized facility wash logs and determined facility was under air discharge reporting requirements.

Barron County Asphalt Plant – Barron, Wisconsin. Annual Emissions Inventory Report and amendments to Mandatory Operating Permit. Facility record keeping and equipment changes to comply with BACT requirement.

River Country Co-operative – Chippewa Falls, Wisconsin. Conducted investigation of agricultural chemicals spill and prepared evaluation and documentation of data and remedial action options report.

Confidential Client – Birchwood, Wisconsin. RCRA Site Investigation and Closure Plan for lead particulate contaminated property. Responsibilities included field investigation, waste handling and disposal, site health and safety evaluation, reporting of data and regulatory negotiation on remediation approach, and preparation of closure documentation.

Fort McCoy Military Reservation – Monroe County, Wisconsin. Completed biotreatability study, provided input to the construction and management of several ongoing ex-situ biopiles. Evaluation of passive design and effectiveness in petroleum remediation.

Pre-Acquisition Site Assessments. Numerous site assessments in western Wisconsin on residential, commercial, and industrial sites. Site assessments were completed for Lutheran Social Services, Cadott Industrial Park, Chippewa County Farm, and City of Ashland Dealer, Manufacturing Co.

Remedial Investigation Projects. Soil and groundwater investigations were completed for a number of public sector clients in western Wisconsin. Sites investigated included Dresel Standard Service; Jill's 76; Jennico, Inc.; Klimek Bulk Facility; Huffcutt Concrete; and The Rafters of New Lisbon, Wisconsin.

I-94 Rest Areas – WisDOT. Coordinated the removal and thermal treatment of petroleum contaminated soils for the WisDOT from two interstate rest areas.

Beth Ann Luebke
Scientist

Education

Bachelor of Science Reclamation, University of Wisconsin-Platteville (1996)

Certifications

Asbestos Building Inspector – Minnesota Department of Health

Asbestos Inspector – Iowa Department of Labor

OSHA 40-Hour Hazardous Waste

American Red Cross – First Aid

American Red Cross – CPR

Professional Associations

National Ground Water Association (NGWA)

General Background

Scientist experienced with Phase I and II Environmental Site Assessments including regulatory agency database searches and collecting, interpreting, and reporting related data, preparation of hydrogeology, geology, and hydrology sections for Phase I and Phase II site investigations, environmental impact statements, soil and groundwater sampling, Regulatory Compliance Audits, classification of soil borings from hand augers, geoprobes, and drill rigs. Licensed Asbestos Inspector in Minnesota and Iowa, and had conducted inspections in both states.

Experience

Cinema Entertainment Corporation – Nebraska and Iowa. Conducted Phase I Environmental Site Assessments at several movie theaters in various cities in Nebraska and Iowa.

Dakota Railroad Corridor – Hennepin County, Minnesota. Conducted a Phase I Environmental Site Assessment of a 43-mile railroad corridor from Wayzata, Minnesota to Hutchinson, Minnesota.

WisDOT – Wausau, Wisconsin. Conducted environmental site assessments for several properties along I-39/USH 51 that may be an environmental concern to an upcoming construction project.

Mn/DOT – Minneapolis, Minnesota. Assisted with a groundwater study at the Highway 55/62 intersection. This included soil borings, soil classification, well installation and water level monitoring.

Mn/DOT – Houlton, Wisconsin. Conducted a Phase I Environmental Site Assessment for construction of a portion of the Highway 35/62 corridor located near the St. Croix River.

Hennepin County – Plymouth, Minnesota. Conducted a Phase I Environmental Site Assessment for realignment and redevelopment of a portion of County Highway 101 corridor.

Savage, Minnesota. Phase II work to determine the degree and extent of soil contamination at a former farmstead located at Eagle Creek Business Park in Savage, Minnesota.

Airport Properties – Cities of Moorhead, International Falls, Anoka Blaine, St. Cloud, Minnesota. Conducted Phase I Environmental Site Assessments for tens of acres at several airports with the state of Minnesota.

Developed Properties – Cities of Savage, Long Lake, Burnsville, Montgomery, and St. Anthony, Minnesota. Provided Phase I Environmental Site Assessments of the listed cities at developed properties located within the city limits.

Vacant Properties – St. Cloud/Vadnais Heights, Savage, Princeton, Biwabik, and Burnsville, Minnesota. Conducted Phase I Environmental Site Assessments of undeveloped properties.

Buffalo, Minnesota. Conducted a Phase I Environmental Site Assessment for a 4.5-mile corridor on Highway 55 through the City of Buffalo. Phase II Environmental Site Investigations were recommended as a result of the ESA.

Deiss Sanitation – River Falls, Wisconsin. Quarterly groundwater sampling and analysis for a location that has been contaminated from an underground storage tank leak.

Mn/DOT – Minnetonka and Wayzata, Minnesota. Vapor Risk Assessment of two locations along I-394. This assessment included the utilization of a photoionization detector (PID)/flame ionization detector (FID), and an explosivity meter, interviewing nearby residents, researching city records, and recording and reporting the results.

City of Montgomery, Minnesota. Phase I Environmental Site Assessment and Phase II Environmental Sampling at a parcel located in Montgomery, Minnesota. Phase II work was recommended due to the unknown site history. Contaminated soil was encountered while conducting Phase II work.

University of Minnesota – Victoria, Minnesota. Phase II work with a Geoprobe® including soil classification, soil sampling, and groundwater sampling. This project also included the compilation of data into a Remediation Investigation/Corrective Action Design (RI/CAD) report.

Municipal Garage – South St. Paul, Minnesota. Quarterly groundwater sampling and analysis for a location that has been contaminated from an underground storage tank leak.

Blaine, Minnesota. Quarterly groundwater sampling and analysis for a location that has been contaminated from an underground storage tank leak.

Goodhue County – Wanamingo, Minnesota. Quarterly groundwater sampling and analysis for a landfill located in Wanamingo, Minnesota.

Goodhue County – Red Wing, Minnesota. Quarterly groundwater sampling and analysis in a landfill and a wetland for a location that has been contaminated from landfill leachate.

Experience prior to joining SEH:

BRW – Norfolk, Virginia. Conducted and completed the first stage for the contamination investigation for an Environmental Impact Statement for a light rail transit line from Norfolk to Virginia Beach, Virginia.

The Pillsbury Company, Honeywell Inc., Pentair Corporation, Gardner Denver Machinery, Inc., and Medtronic as well as many local and regional lending institutions, developers and industries. Conducted and completed Several Phase I Environmental Site Assessments at locations in Minnesota, Wisconsin, Illinois, Indiana, Ohio, New Jersey, Oklahoma, Texas, Michigan, North Dakota, South Dakota, and Montana.

Regulatory Compliance Audits – Minnesota, Oklahoma, New Jersey, Ohio, and Texas. Assisted in conducting limited Environmental Regulatory

Compliance Audits addressing hazardous materials, air emissions, wastewater, hazardous waste, solid waste, CERCLA/SARA Title III reporting, spill prevention and storm water permit requirements at industrial and manufacturing facilities for several national and international clients.

United States Postal Service – Minnesota and Wisconsin. Organized environmental health and safety training program requirements for the employees of the Post Offices, Vehicle Maintenance Facilities, Processing and Distribution Centers, Bulk Mail Center, and Air Mail Facility.

Storm Manufacturing, Inc.– Norman, Okalomha. Environmental Site Assessment and limited regulatory compliance audit.

Wilbros Engineering – Northern Minnesota, Upper & Lower Michigan, and Northern Wisconsin. Classified soil borings in wetlands and at river crossings for a major pipeline expansion project.

McGrew Color Graphics – Kansas City, Missouri. Phase II work to determine the degree and extent of soil and groundwater contamination at former newspaper printing facility.

Ohio Medical Instruments – Cincinnati, Ohio. Environmental Site Assessment at a facility that manufactures medical instruments for neurological surgery.

Stella Foods – Thorp, Wisconsin. Conducted Phase I Environmental Site Assessment and Environmental Regulatory Audit at the cheese manufacturing facilities.

Minnesota, Wisconsin, Iowa, Missouri, and Indiana. Conducted soil, groundwater, and radon sampling for several sites in these states.

Seneca – Clyman and Mayville, Wisconsin. Collected groundwater samples and determined groundwater parameter data (pH, temperature, dissolved oxygen, biological oxygen demand) from monitoring wells at the Seneca Plants contaminated with petroleum products.

Ansul – Marinette, Wisconsin. Conducted soil sampling to determine the degree and extent of contamination throughout the Ansul property.

Ingstad Broadcasting – Southeastern Minnesota. Completed several Environmental Transaction Screens of radio transmission towers and radio stations.

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Rosalind A. Schoof, Ph.D., DABT
Principal

PROFESSIONAL PROFILE

Dr. Rosalind A. Schoof is a consultant in toxicology and risk assessment. She is a board-certified toxicologist with more than 20 years experience in assessing human health effects and exposures from chemical substances, and has coordinated and reviewed numerous risk assessments of chemical substances in groundwater, soil and surface water. Dr. Schoof has conducted evaluations of environmental chemical toxicity, health risk assessments for cancer and noncancer end points, and multimedia assessments of exposure to environmental chemicals at diverse manufacturing sites, including brownfield sites and military installations. These evaluations have included numerous studies of intrusion of vapors of chlorinated solvents and other volatile chemicals found in soil and groundwater into overlying buildings.

Dr. Schoof is a nationally-recognized expert on evaluation of arsenic in the environment and on the bioavailability of metals from soil, with many publications in peer-reviewed journals on these topics. She has given invited talks on bioavailability at numerous national conferences and workshops, and directed the development of a white paper on the bioavailability of metals in soil for the National Environmental Policy Institute. Dr. Schoof was a member of the NRC Committee on Toxicants and Pathogens in Biosolids Applied to Land and is currently serving on another NRC committee examining toxicological risks to deployed military personnel.

Dr. Schoof previously worked for a pharmaceutical company where she developed safety assessment research programs for new drug candidates, designed protocols and directed mammalian toxicity studies in accordance with Good Laboratory Practices, and oversaw the conduct of such studies in contract laboratories.

CREDENTIALS AND PROFESSIONAL HONORS

Ph.D., Toxicology, University of Cincinnati, 1982.
B.A., Molecular Biology, Wellesley College, 1975.
Diplomate, American Board of Toxicology, 1986.

Society of Toxicology
Society for Risk Analysis
Society for Environmental Geochemistry and Health

RELEVANT EXPERIENCE

Nickel Refinery Risk Peer Review, Ontario—Member of international peer review panel for risk assessment of exposures to nickel and other metals in Port Colborne, Ontario. Participated in media briefing and community open houses to explain role of peer review panel. Named by the Ontario Ministry of the Environment as a testifying expert for executive review tribunal.

Arsenic Water Quality Criteria Re-evaluation—Conducted a literature review and prepared a manuscript supporting a USEPA re-evaluation of the ambient water quality criterion (AWQC) for human health effects of arsenic. Calculated AWQC using studies on bioconcentration factors and arsenic speciation acquired from the literature review.

Brownfield Human Health Risk Assessment, South Charleston, WV—Performing evaluations of risks associated with soils, groundwater and a river affected by chlorinated organic compounds released from a former carbon tetrachloride production facility in West Virginia. The risk evaluations are conducted in accordance with the tiered system established by the state for the Voluntary Remediation Program. Focus is on assessing potential risks from exposures to volatile chlorinated organic compounds infiltrating planned new commercial buildings as parcels are put up for sale and utility and construction trenches. USEPA's latest versions (2001) of the Johnson & Ettinger advanced building infiltration via groundwater and soil models were used to evaluate potential impacts to indoor air in future buildings. Participated in stakeholder meetings and public briefings regarding assessments of potential site risks before and after redevelopment.

California Mining Site Risk Assessment—Conducting a series of human health risk assessments evaluating metals in sediments, surface water and other media downstream of a copper and sulfur mine site in California. Exposure scenarios include both recreational and Native American activities.

Utah Metal Processing Site Risk and Bioavailability Support—Providing human health risk assessment support for evaluation of lead and arsenic in soils at a former mineral processing site in Utah. The site is currently a wildlife refuge. Recreational exposures onsite and exposures in an adjacent residential area are being evaluated. In vitro bioavailability studies and mineralogical evaluations of lead and arsenic were conducted under Integral's direction and results used in the site risk assessment.

Regulatory Comment—Submitted comments on a California draft public health goal for arsenic in drinking water.

New Facility Air Permit Support in Washington—On behalf of private developer, derived a risk-based acceptable new source impact level (ASIL) for use in evaluating predicted air releases of 1,3-butadiene from a proposed recreational facility in Washington.

Navy Bioavailability Field Guide—Updated a Field Guide for use by Department of the Navy project managers in evaluating the bioavailability of metals in soil to both ecological and human receptors at contaminated sites. Also contributed major sections of the original Field Guide.

Brownfield Redevelopment Risks—Providing human health risk support to a midwestern city environmental department for several redevelopment properties with possible arsenic and lead contamination. Activities include evaluation of background concentrations and human health risk assessment.

School Property Pesticide Evaluation—For a New York State School District, evaluated potential exposures of students to pesticide residues in athletic field soils. Arsenic was primary concern. Also evaluated potential association of lymphoma cases to pesticides detected in soil.

School Property Evaluation—On behalf of a school board in New York State, critically evaluated a state investigation of contamination at a high school built on a former industrial site. Presented findings at a public meeting of a citizen's advisory committee.

Pesticide Manufacturing Facility Evaluation—Directed the development of risk-based cleanup levels for arsenic in offsite soils near a former arsenical pesticide manufacturing facility in New York. Offsite areas included a public school complex. Presented client's position to New York State Department of Environmental Conservation RCRA staff and New York State Department of Health staff. Made presentations to a public advisory group for the facility, and at school board and community meetings.

Chemical Distribution Facility Risk Communication, New Jersey—Prepared fact sheets for a chemical distribution facility with chlorinated volatile organic chemicals present in soil and groundwater. Fact sheets were distributed to neighboring business as part of an indemnity and access agreement. Preparation of fact sheets required reviewing site data, evaluating vapor intrusion modeling, identifying chemicals of potential concern, researching chemical toxicity, and determining the nature of potential exposures and likelihood of these exposures being of concern.

Vapor Intrusion Litigation , Seattle, WA—Named as testifying expert and prepared for deposition in litigation related to potential impacts of infiltration of vapors from volatile chemicals in groundwater into a business adjacent to a waste chemical processing facility. Conducted in-depth review of baseline risk assessment, inhalation pathway assessment, and state health consultation prepared for site; evaluating building vapor intrusion modeling; critically assessing USEPA's Johnson and Ettinger model; assessing potential employee exposures; and researching toxicity assessments of chlorinated volatile organic chemicals and benzene. Compiled list of technical questions to be asked of opposing expert.

Historic Landfill Risk Evaluation—Directing evaluations of human health and ecological risks associated with sediment affected by releases from an historic landfill along the Kanawha River in Nitro, West Virginia. Risk assessments will be used to support a voluntary cleanup application so that the site can be redeveloped as a boat ramp park.

TPH Standards Guidance Review, West Virginia—Critically reviewed draft supplemental guidance on development of total petroleum hydrocarbons risk-based standards for the West Virginia Department of Environmental Protection. Integral verified applicability of analytical methods and TPH carbon range fractions proposed and evaluated appropriateness of toxicity factors developed in the guidance. Provided review comments in context of the TPH Criteria Working Group guidance documents and Massachusetts TPH risk policy.

Evaluation of Arsenic and Cadmium Risks from an Operating Lead and Zinc Smelter, British Columbia — On behalf of a stakeholder group, conducted risk assessment for exposures to arsenic and cadmium in soil in a community with an operating lead and zinc smelter. Presented results to stakeholder group.

Historic Copper Mine Site, Montana—Evaluated potential exposures and risks posed by elemental mercury, lead and arsenic in basements of homes built on the site of former mining operations. Potential exposures to lead, arsenic and mercury in attic dust, indoor dust in living areas and in soils was also evaluated.

Former Copper Smelter Site, Washington—For negotiations and legal action related to a former smelter site in Washington state, assembled and summarized literature related to assessment of exposures to arsenic in soil. Attended stakeholder meetings, and made presentations on arsenic toxicity and risk assessment. Reviewed and commented on State documents. Prepared affidavit addressing issues related to arsenic toxicity and risk assessment.

Copper Mining District Releases, Utah—Prepared deposition describing limitations of potential adverse effects associated with lead and arsenic in a riverbed near a residential area downstream of a mining site in Utah, was deposed by U.S. Dept. of Justice and U.S. Environmental Protection Agency attorneys, and testified for an alternative dispute resolution.

Pesticide Manufacturing Facility Releases, Texas—Made a presentation to a district attorney and investigators conducting a manslaughter investigation related to chemical releases from a pesticide manufacturing facility.

Sub-title D Municipal Landfill Permitting, New Mexico—For client attempting to site a sub-title D municipal landfill, prepared an affidavit rebutting assertions regarding potential adverse health effects of such landfills. Affidavit was submitted to the docket for the permit hearing, and resulted in withdrawal of the allegations.

Brownfield Redevelopment Vapor Intrusion Risk Assessment, California—For large industrial/commercial brownfield redevelopment project in California, conducted indoor air risk assessment using Johnson & Ettinger model to assess risks from chlorinated solvents in soil and groundwater. Presented findings to potential purchaser and to State regulators.

Evaluation of Nickel Carcinogenicity—Critically evaluated the potential carcinogenicity of different forms of nickel present at a former steel mill site.

Hazardous Waste Combustor Risk Assessment Work Plan, Idaho—Managed preparation of human health risk assessment work plans for a planned hazardous waste combustor following the latest (1998/1999) EPA risk assessment guidance. Project included extensive negotiations with EPA and Tribal representatives, as well as intensive coordination with the engineering design team.

Zinc Smelter Risk Assessment and Bioavailability Research Program, Oklahoma—Managed human health risk assessment tasks for the work plan, remedial investigation, and feasibility study of cadmium, lead, and arsenic in soil at a former zinc smelter site in Bartlesville, Oklahoma. Planned for collection of site-specific data to fill gaps in EPA's baseline human health risk assessment, including paired soil and indoor dust samples, "hot spot" delineation, and a bioavailability study of cadmium and lead in soil. Directed development of revised remediation goals for arsenic, cadmium, and lead using site-specific data and preparation of position papers supporting the recommended goals. Consideration of reduced bioavailability from soil and reduced toxicity in the presence of zinc resulted in soil cadmium cleanup levels of 100 and 200 mg/kg for residential and occupational land use, respectively. A lead cleanup level for occupational areas was derived using an adult lead exposure model. Monte Carlo analyses were used to document protectiveness of cadmium and arsenic cleanup levels. Presented plans and results to EPA and state staff and at public meetings. Assisted in negotiating cleanup levels for cadmium, lead, and arsenic that subsequently reduced remediation scope and cost by $50 million.

Mining and Smelting Site Strategic Risk Assessment Support—Over an 8-year period, managed a multi-site general risk assessment support contract for mining and smelting sites throughout the Rocky Mountain region. In addition to providing risk assessment support for specific sites, responsibilities included ensuring that risk assessment strategies and positions were consistent from site to site and that risk assessment strategies were coordinated with litigation strategies. Identified pivotal sources of uncertainty affecting risk estimates for many sites and helped design and conduct research to support more realistic assessments of risks. Presentations were regularly made to EPA and state staff on behalf of the client.

Copper Smelter Risk Assessment Research Program, Montana—Provided strategic risk assessment support during an 8-year period for the evaluation of four operable units at a former copper smelter site in Anaconda, Montana. A research program was developed to fully characterize potential risks associated with arsenic, cadmium, and lead in soil and waste materials from copper smelting operations. Participated in review of work plans and data interpretation by a working group of client and EPA staff and consultants. An epidemiology study demonstrated that current exposures were negligible, and studies of arsenic bioavailability and soil ingestion provided support for site-specific assumptions. Soil arsenic cleanup levels of 250, 500, and 1,000 mg/kg for residential, industrial, and recreational areas, respectively, were adopted based on the application of these site-specific studies in the human health risk assessments for the site.

Copper Mine Site Risk Assessment Program, Montana—Managed preparation of a series of position papers describing the proper methods for evaluating exposures to lead and arsenic from mining wastes in soils, groundwater, and surface water in Butte, Montana. Soil issues included evaluation of the uncertainties associated with EPA's oral carcinogenicity assessment for arsenic, bioavailability of lead and arsenic in soils, and discussion of appropriate ways to apply the uptake biokinetic model and community blood-lead studies to assessments of lead exposures. Prepared documents describing the proper methods to evaluate risks from groundwater and surface water contaminated with arsenic, lead, cadmium, and other metals released as mining by-products at several operable units. Comments were also prepared on baseline risk assessments and preliminary remedial goals from EPA and state agencies.

Metal Bioavailability Research Program—Managed a bioavailability research program of arsenic and lead in soils contaminated by mining and smelting wastes that demonstrated reduced absorption of these metals from soils. Mineralogic analyses and in vitro screening studies were used to help interpret the results of animal studies. Research results have been published in peer-reviewed journals and have been cited by EPA in support of precedent-setting changes in risk assessment assumptions that resulted in much higher cleanup levels.

Taiwanese Dietary Arsenic Research Project—Directed investigation of inorganic arsenic intake in the diet of people living in areas of Taiwan with elevated arsenic concentrations in artesian well water. Samples of rice and yams collected in Taiwan showed that arsenic intake from the Taiwanese diet was much higher than previously assumed, suggesting that EPA's toxicity values might overestimate arsenic toxicity.

U.S. Dietary Arsenic Research Project—Directed an investigation of dietary arsenic intake in the United States. A market basket survey of 40 commodities demonstrated the presence of inorganic arsenic as a normal occurrence in the American diet.

Navy Site Risk Assessment Support—Provided strategic guidance for risk assessment efforts for several Navy facilities. Participated in stakeholder meetings, and reviewed draft documents.

Mercury Bioavailability Research and Risk Analysis, New Jersey—Provided guidance for risk assessment strategy at a former manufacturing site in New Jersey with mercury and dioxin contamination. Guided the design of studies of mercury bioavailability from soil, and prepared a comprehensive report presenting the results and justifying the selected approach for submittal to the state. Directed study of evaluating mercury vapor release from soil. Assisted in a comparison of dioxin data with regional background values.

Assessment of Soil Arsenic Background and Risks, Illinois—Provided support in assessing potential risks associated with arsenic in soil in residential areas surrounding an operating glass factory in Illinois. Prepared a presentation for the Illinois Environmental Protection Agency and Department of Health and developed statistically defensible sampling plans to compare site concentrations to background. Prepared a comprehensive report proposing an innovative approach to identifying safe arsenic concentrations in soil for submittal to the state.

Pesticide Manufacturing Facility, Texas—Prepared an exposure pathway analysis for a former pesticide manufacturing facility in Texas that has elevated concentrations of arsenic in soil, interior dust, groundwater, surface water, and lake sediments. Assisted in designing a soil sampling plan for site investigations overseen by the Texas Natural Resources Conservation Commission.

Evaluation of Vapor Intrusion from Groundwater, Minnesota—Provided support in assessing potential exposures of residents and workers at a site in Minnesota to chlorinated volatile hydrocarbons in a groundwater plume. The chemicals evaluated include vinyl chloride, 1,1-dichloroethene, trichloroethene, and tetrachloroethene. Exposure pathways include infiltration from groundwater into basement air.

Risk Evaluation of Chromium in Groundwater—Directed a screening-level evaluation of human health and ecological risks associated with chromium(VI) in a golf course pond and ditch in Montana. Evaluated transport and fate of chromium in a groundwater plume and potential impacts to a nearby river. Efforts supported a response action based on natural attenuation, with groundwater monitoring and a continuation of existing institutional controls on groundwater and land use.

Risk Assessment for Voluntary Cleanup of Mining Site, Colorado—Directed the development of risk assessment strategy for a mining site being addressed by the client under the 1994 Colorado Voluntary Cleanup and Redevelopment Act. Chemicals evaluated included arsenic, lead, and manganese. Extensive background investigations were conducted.

Lead Smelter Risk Evaluations, Utah—Provided risk assessment support for agency negotiations, site investigation strategy, and document review for several smelter sites in the Salt Lake Valley in Utah. Evaluated risks associated with arsenic, cadmium, and lead in soil and slag, considering residential and occupational exposures. Provided comments on EPA risk assessment, and represented client in meetings with agency. Designed and directed a study of lead bioavailability in rats, in which site soils containing lead were added to the rat diet.

Wood Treatment Site Risk Evaluations, Montana—Managed preparation of documents describing the proper methods of evaluating human health and ecological risks from PCP, PAH, and dioxin contamination at a pole-treating plant in Butte, Montana. Assessed risks from exposures to soil, groundwater, surface water, and air.

Evaluation of Ocean Disposal of Dioxin-Containing Sediments—For the U.S. Army Corps of Engineers, performed a risk assessment for ocean disposal of dioxin-contaminated sediments from Grays Harbor, Washington. Evaluated potential exposures to dioxins in Dungeness crabs that might contact contaminated sediments in an ocean disposal site for dredged materials. Evaluation included derivation of site-specific crab consumption values and crab life cycle evaluation.

Bulk Fuel Terminal Risk Evaluation, Washington—Provided senior review for a project to develop risk-based cleanup levels for a former bulk fuel terminal in Seattle, Washington.

Bulk Fuel Facility Risk Evaluation, Washington—Provided senior review for the development of soil and groundwater cleanup levels for a former bulk fuel facility, currently being used as a municipal park, in Kirkland, Washington. Cleanup standards were developed using Washington State's Model Toxics Control Act Method B. Substances included petroleum constituents such as BTEX and PAH compounds.

Gas Station Risk Evaluation, Washington—Provided senior review for development of soil cleanup levels using Washington State's Model Toxics Control Act Method B for a former gas station in Seattle, Washington.

Risk Evaluation for Petroleum Transfer Station, Alaska—Assisted in preparing a work plan and risk assessment to assess risks and develop cleanup levels for benzene-contaminated groundwater from leakage of petroleum products at a transfer station in Alaska. Groundwater was demonstrated to be unsuitable as a domestic water source, and the need for remediation was based on potential exposures to volatile chemicals transferred into homes from the basement or ground level.

Navy Facility Risk Evaluations, Washington—Served as project manager for USEPA technical enforcement support oversight activities at several U.S. Navy NPL sites in Washington. Provided human health risk assessment guidance, and coordinated review of all aspects of remedial investigation work plans and reports. Contaminants included chlorinated hydrocarbons, solvents, metals, and fuels. Primary exposure pathways included groundwater, surface water, and marine organisms exposed to contaminated sediments.

Municipal Incinerator Risk Assessment, Seattle—For the City of Seattle Solid Waste Utility, performed public health and risk analysis for a municipal incinerator as part of an EIS on waste reduction, recycling, and disposal alternatives for Seattle, Washington. Assessed risks from stack emissions of metals, dioxins, and other organic compounds. Presented methods and results to local, state, and federal officials, environmental groups, the public, and a peer review committee.

Hazardous Waste Incinerator Risk Evaluation, Florida—Directed human health and ecological risk assessment support activities for a private client opposing the permit application for a hazardous waste incinerator in Polk County, Florida. Critiqued a risk assessment submitted to the state in support of the permit for the incinerator.

Hazardous Waste Incinerator Risk Evaluation, New Jersey—Performed a preliminary risk assessment for the development of a hazardous waste incinerator in New Jersey.

Hazardous Waste Incinerator Risk Assessment Peer Evaluation—Provided extensive peer review comments on methods and results of a risk assessment on a hazardous waste incinerator in Kentucky.

Municipal Incinerator Risk Analyses, Washington—Developed procedures and preliminary assessments for a municipal incinerator planned by a Native American tribe in Washington.

Petroleum Refinery RCRA Risk Assessment, Colorado—Prepared a human and environmental assessment work plan for a RCRA facility investigation of a petroleum refinery in the western United States. Key contaminants included BTEX, PAHs, and chlorinated hydrocarbons.

Underground Storage Tank Evaluation—For Alaska Dept. of Environmental Conservation (as subcontractor), determined technical requirements and critically reviewed risk assessment and proposed groundwater cleanup levels for a gasoline leak from an underground storage tank in Alaska. Provided guidance for risk management strategy.

Reservoir Sediment Risk Evaluation—Assisted in preparing a document describing the proper methods of evaluating human health risks associated with recreational exposures to arsenic, cadmium, and lead in sediments at a reservoir in Montana.

Lead Mining District Risk Evaluations, Colorado—Advised client of best methods for assessing lead exposures at a historic mining site in the Rocky Mountains. Described available data and appropriate methods for comparing the bioavailability of lead from soil, slag, mining wastes, and tailings. Critiques were provided for community blood-lead studies and the application of the uptake biokinetic model to assess lead exposures at the site.

Regulatory Comment—For an industry association, directed the preparation of comments on the Proposed Rule on the Bevill Exclusion for Mining Wastes. Critiqued EPA's assessment of damages to human health and the environment caused by land-based units, and concluded that most of the damages cited by EPA are only of historical relevance and do not reflect current mining practices. Also critiqued the use of the toxicity characteristic leaching procedure as a means of measuring the toxicity of mineral processing wastes, and concluded that it is an overly aggressive and unrealistic test for evaluating these materials.

Risk-Based Cleanup Goals for a Barium Ore Site, California—Provided strategic guidance and senior review for development of risk-based preliminary remediation goals for barium in soil at a former ore processing plant in Modesto, California, that was expected to be redeveloped as an industrial or recreational park.

Hazardous Waste Site Risk Assessments—For Oregon Dept. of Environmental Quality, provided strategic guidance and senior review for two risk assessments on hazardous waste sites in Oregon: a baseline risk assessment conducted for a former wood-treatment facility that used PCP, creosote, and arsenical fungicides and a screening-level human health risk assessment for a hazardous waste site located in a unique desert environment. Key issues evaluated at the wood-treating facility included uncertainties in the slope factor for PCDDs and PCDFs and the comparative risks associated with consumption of fish and crayfish from reference locations. Potential contaminants of concern at the desert site included PCDDs and PCDFs, chlorinated phenoxy herbicides, lead, TCE, and benzene.

Chloralkali Manufacturing Site Risks, New York—Provided senior review and guidance for an assessment of risks associated with mercury and PCBs in fish in Onondaga Lake. The impact of a former chloralkali facility on site risks was evaluated in comparison to the impacts of other sources in Onondaga and other comparable lakes.

Risks of Herbicide Application to Lakes—For Washington Department of Ecology, updated and revised a human health risk assessment for an EIS on the application of herbicides to Washington lakes.

Munition Facility Risk Evaluations—Provided human health risk assessment guidance and work plan review for CERCLA and RCRA investigations of a federal facility in Oregon contaminated with munitions.

Bioavailability of metals in Refinery Soil—Provided strategic guidance and senior review for an evaluation of the bioavailability of arsenic, beryllium, and lead from soil at an operating refinery in New Jersey.

Manufacturing Facility Risk Assessment, Ohio—Provided senior review for human health risk assessment components of an expedited RI/FS for an alloy and chemical production facility in Ohio that has produced both radiological and chemical wastes. Tasks include designing and implementing the baseline risk assessment for an operating facility and participating in the selection of cleanup levels and remedial actions. Primary chemicals of concern include arsenic, chromium, vanadium, and the radionuclide decay chains of thorium-232 and uranium-238.

Pulp Mill Risk Assessment, Alaska—Provided senior review of human health risk assessment issues for an RI/FS of marine areas potentially affected by releases from a pulp mill. Reviewed a work plan to identify potential human health risks associated with exposure to substances in sediments that may bioaccumulate to fish. Key issues include identifying appropriate background concentrations of PCDDs/PCDFs in fish and shellfish in the region and at other United States locations and selecting representative fish consumption rates for use in the risk assessment.

Assessment of Mercury Risks for Instrument Manufacturing Site, New York—Provided senior review for the development of alternative cleanup levels for mercury in site soils using site-specific bioavailability data from a former instrument manufacturing facility in Rochester, New York.

Manufacturing Facility Risk Assessment, California—Provided technical review for a comprehensive baseline human health risk assessment for a former manufacturing facility in southern California. More than 30 chemicals of potential health concern were detected in soil, groundwater, or ambient air, including BTEX, nitro, phenolic, and chlorinated organic compounds.

Military Installation Risk Assessment, California—Provided strategic guidance and senior review for multipathway human health and ecological risk assessments for a military installation in San Francisco, California, comprising 11 major study areas and more than 40 individual sites. The risk assessments were used to support the selection of sites to be considered in the feasibility study and for the development of preliminary soil cleanup levels. Chemicals of concern included metals, volatile organic compounds, PAHs, PCBs, and pesticides.

Appliance Manufacturing Site Risk Assessment—Assisted in developing an approach to assess human health risks from lead in soil and sediment at a television manufacturing facility in Ohio.

PCB Risk Assessment Sensitivity Analysis—Directed a PCB risk assessment sensitivity analysis project. Identifying those components of risk assessment methodology that have the greatest influence on PCB cleanup levels.

EIS Health Impact Analysis—For Washington Dept. of Ecology, evaluated potential human health impacts of cleanup alternatives for an EIS for Washington State's Model Toxics Control Act. Participated in developing the risk-based alternative.

Methylmercury Exposure Study—For the Norton Sound Health Cooperative, participated in planning and design of a study of methylmercury concentrations in hair of native Alaskans subsisting on fish and sea mammals in Nome, Alaska.

Risks of Road Fill—Assisted the Alaska Dept. of Transportation (as subcontractor) in a preliminary assessment of risks from metals and pesticides in fill material used during construction of a road in Alaska.

PUBLICATIONS

Schoof, R.A., L. Williams, J.W. Yager. In preparation. Critical evaluation of ambient water quality criterion for arsenic: speciation and bioaccumulation issues.

Tsuji, J.S., R. Benson, R.A. Schoof, G.C. Hook. Submitted. Health effect levels for assessing childhood exposure to arsenic in soil.

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Schoof, R.A., and C.S. Baxter. 1986. Topical application of a tumor promoter induces proliferation of an adherent cell population in murine spleen. *Int. J. Immunopharm.* 8:455–462.

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Baxter, C.S., R.A. Schoof, and A.T. Lawrence. 1984. Interaction of tumor promoting agents with immunofunctional cells in vitro and in vivo. International Agency for Research on Cancer Scientific Publications, No. 56.

INVITED PRESENTATIONS/PANELS/PEER REVIEWS

4/03 – U.S. Environmental Protection Agency: Invited Speaker at workshop on bioavailability of metals in Tampa, FL. Gave talk on the role of bioavailability model validation in site-specific decision-making.

8/02 to present – National Research Council: Appointment to Committee on Toxicological Risks to Deployed Military Personnel.

8/02 - U.S. Environmental Protection Agency: Peer review of draft "Estimates of Soil Ingestion in Children", by Cain, et al.

6/02 – Mealey's Emerging Toxic Tort Conference: Lecture titled "Up to Date Analysis of Water contamination Cases: the Science", Pasadena, CA.

3/01 to 6/02 – National Research Council: Appointment to Committee on Toxicants and Pathogens in Biosolids. Book issued titled *"Biosolids Applied to Land: Advancing Standards and Practices"*. Participated in Congressional briefing of committee findings.

4/02 - Center for Environmental & Occupational Risk Analysis and Management, College of Public Health, University of South Florida, Tampa: Lecture titled "Consideration of background exposures and bioavailability in designing arsenic biomonitoring studies".

3/02 – Electric Power Research Institute Advisory committee meeting. Lecture titled "Arsenic exposure and risk: Public perception vs. likely exposure pathways".

10/01 – Ontario Ministry of the Environment. Member of international peer review panel evaluating draft risk assessment for the Rodney Street Community in Port Colborne.

10/01 – Contaminated Soils, Sediments and Water annual conference: Lecture titled "Methodological issues in assessing dermal absorption of chemicals" in Dermal Bioavailability session.

9/01 – Northwest Biosolids Management Association annual conference: Keynote speech describing the National Research Council biosolids committee membership and charge.

4/01 - U.S. Environmental Protection Agency: Peer review of draft Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.

3/01 – Society of Toxicology annual meeting: Lecture on metal bioavailability in continuing education course on risk assessment of metals.

3/01 – Society of Toxicology annual meeting: Co-chair of workshop on consideration of bioavailability in risk assessment.

2/01 – Secretary of the Navy Environmental Awards FY 2000: Judge.

9/00 – Agency for Toxic Substances and Disease Registry: Technical review of Mercury Releases from Lithium Enrichment at the Oak Ridge Y12 Plant, July 1999.

9/00 – U.S. Environmental Protection Agency: Peer review of draft documentation for short-term arsenic toxicity value.

5/00 – Agency for Toxic Substances and Disease Registry: Peer review of draft toxicity profile for creosote.

10/99 – 15th Annual International Conference on Contaminated Soils and Water (AEHS): Organized 3 hour workshop (taught with 2 colleagues) titled "Development of site-specific bioaccessibility and bioavailability data and their application to human health risk assessment", Co-organized and co-chaired technical session titled "Bioavailability of contaminants in soil, Amherst, MA, October 1999.

10/99 – National Institute of Environmental Health Sciences Superfund Basic Research Program grant application review, special emphasis panel member, Research Triangle Park, NC, October 1999.

7/99 – ASCE-CSCE Environmental Engineering Conference: "Application of bioavailability to environmental cleanup settings: case studies", Norfolk, VA, July 1999.

5/99 – Chemical Manufacturer's Association Exposure Assessment Workshop: Member of panel making recommendations regarding research projects CMA should fund in the area of dermal exposure assessment, Research Triangle Park, NC, May 1999.

5/99 – U.S. Dept. of the Navy Remediation Innovation Technology Seminar series: One of four primary speakers for day long course. Topic was "The role of bioavailability in risk assessment", San Diego and San Francisco, CA, Silverdale, WA, Philadelphia, PA, Charleston, SC, and Honolulu, HI, May 1999.

12/98 – U.S. Environmental Protection Agency Workshop on Issues Associated with Dermal Exposure and Uptake: Peer consultant reviewing draft risk assessment guidance, Bethesda, MD, December 1998.

12/98 – National Environmental Policy Institute Conference-Bioavailability: Using What We Know, Learning What We Need: "Why consider bioavailability in risk assessment?", Washington, D.C., December 1998.

8/98 – U.S. Environmental Protection Agency Modeling Lead Exposure and Bioavailability Workshop: "Interpreting in vitro bioavailability studies", Durham, NC, August 1998.

7/98 – Third International Conference on Arsenic Exposure and Health Effects: "A market basket survey of inorganic arsenic in food", San Diego, CA, July 1998.

12/97 – IBC's International Congress on Human Health Bioavailability: "Practical experience in developing/negotiating the use of bioavailability adjustments", Scottsdale, AZ, December 1997.

9/96 – U.S. Environmental Protection Agency and U.S. Department of Energy Mercury Speciation Workshop: "Biological models to predict soil mercury bioavailability to humans", Denver, CO, September 1996.

12/96 – U.S. Geological Survey Arsenic Workshop: "The role of bioavailability studies in deriving risk-based cleanup levels for arsenic in soil", Sutter Creek, CA, December 1996.

3/96 – NJDEP Interagency Risk Assessment Committee: "Assessing the oral bioavailability of metals in soil", Trenton, NJ, March, 1996.

8/95 – ATSDR Science Panel on the Bioavailability of Inorganic Mercury: Served as a member of an Agency for Toxic Substances and Disease Registry (ATSDR) expert science panel on the bioavailability of mercury in soil. Served as lead author on a manuscript reviewing methods and available data for assessing the oral absorption of various forms of inorganic mercury, Atlanta, GE, August 1995.

12/95 – TNRCC Arsenic Symposium: Served as one of four invited experts at a 1-day symposium to brief toxicologists and project managers from the Texas Natural Resource Conservation Commission on the latest developments in assessing risks associated with arsenic in soil, Austin, TX, December 1995.

1992 – Oregon DEQ Cross Media Advisory Committee: Appointed by the Director of the Oregon Department of Environmental Quality (DEQ) to serve on an advisory committee that reviewed and commented on the methodology developed by DEQ to evaluate cross-media regulatory impacts and develop a more integrated approach to the permit process. Also participated in technical subcommittee of toxicologists that provided detailed technical review of a comparative risk assessment model developed to rank chemical exposure and hazard to human and ecological receptors, Portland, OR, 1992-1993.

PRESENTATIONS/POSTERS

R.A. Schoof, L.J. Yost. 2002. Estimation of inorganic arsenic intake from fish: Market basket *vs.* recreational catches. Toxicological Sciences 66 (1-S) Abstract 1698: 347.

L.J. Yost, R.A. Schoof, M. Garry. 2002. Estimation of dietary intake of inorganic arsenic in children. Toxicological Sciences 66 (1-S) Abstract 1696: 346.

R.A. Schoof, J.S. Tsuji. 2000. The role of outdoor dust in exposures to chemicals in soil: Case studies for arsenic. Toxicological Sciences 54 (1-S) Abstract 1168: 249.

J. Tsuji, R. Schoof, and G. Hook. 2000. Subchronic health effect levels for childhood exposure to arsenic. Toxicological Sciences 54 (1-S) Abstract 346: 73.

Ruby, M. V., R. A. Schoof, and M. J. Carpenter. 1999. Arsenic bioaccessibility and mineralogy from soils at a pesticide manufacturing facility, 15th Annual Conference on Contaminated Soils and Sediments, Amherst, MA.

Menzel, D.B., M.B. Dillencourt, D.M. Meacher, E. Lee, L.F. Bic, R.A. Schoof, L.J. Yost, C.H. Farr, and D.W. Cragin. 1999. Monte Carlo analysis of inorganic arsenic exposure in the U.S. Toxicological Sciences 48 (1-S) Abstract 1650: 350.

Evans, C.G. and R.A. Schoof. 1998. Soil screening levels for cadmium should account for adult exposures and background exposures. Toxicological Sciences 42 (1-S) Abstract 205:41.

Schoof, R.A. and C.G. Evans. 1998. Use of background arsenic exposure data to assess health significance of exposures to arsenic in soil. Toxicological Sciences 42 (1-S) Abstract 1130:229.

Smith, J.S., M.L. Moore, and R.A. Schoof. 1997. Is mercury an environmental endocrine disruptor? Presented by R.A. Schoof at International Conference on Human Health Effects of Mercury Exposure, Torshavn, Faroe Islands.

R.A. Schoof and L.Y. Yost. 1996. Arsenic intake from the Taiwanese diet. Toxicologist 30(1) Abstract 251:49.

R.A. Schoof and G.B. Freeman. 1995. Oral bioavailability of lead and cadmium in soil from a smelter site. The International Toxicologist. Abstract 86-P-15. Abstracts of the International Congress of Toxicology – VII, Seattle, WA.

Schoof, R.A., G.B. Freeman, S.C. Liao, and P.D. Bergstrom. 1995. Determination of the oral bioavailability of soluble arsenic and arsenic in soil and house dust in Cynomolgus monkeys. Toxicologist 15(1) Abstract 712:134.

Ruby, M.V., A. Davis, R. Schoof, and S. Eberle. 1995. Development of a physiologically based test to estimate lead bioavailability. Toxicologist 15(1) Abstract 718:135.

R.A. Schoof, R.A. Pastorok and N.W. Gard. 1995. Assessing the oral bioavailability of metals in soil in terrestrial animals. The Second SETAC World Congress Conference, Vancouver, B.C., Canada.

Schoof, R.A., L.J. Yost, B. Beck, and P. Valberg. 1994. Recalculation of the oral arsenic reference dose and cancer slope factor using revised assumptions of inorganic arsenic intake from food. Toxicologist 14(1) Abstract 51:36.

Yost, L.J., and R.A. Schoof. 1995. Risk assessment for arsenic in a marine outfall, including consideration of local seafood consumption rates and fractional intake. Book of Posters: Society for Environmental Geochemistry and Health Second International Conference on Arsenic Exposure and Health Effects, San Diego, CA.

M.V. Ruby, R. Schoof, and S. Eberle. 1995. Development of a physiologically based test to estimate arsenic bioavailability. Book of Posters: Society for Environmental Geochemistry and Health Second International Conference on Arsenic Exposure and Health Effects, San Diego, CA.

R.A. Schoof and M.V. Ruby. 1994. Prediction of soil arsenic bioavailability based on speciation and bioaccessibility data. Geological Society of America Annual Meeting, Seattle, WA.

Yost, L.J., and R.A. Schoof. 1993. Implications of the methylation status of arsenic in home-grown vegetables for risk assessment. Book of Posters: Society for Environmental Geochemistry and Health International Conference on Arsenic Exposure and Health Effects, July 28, 1993, New Orleans, LA.

Schoof, R., M.J. Steele, C. Petito Boyce, and C.G. Evans. 1993. Assessing the validity of lead bioavailability estimates from animal studies. Toxicologist 13(1) Abstract 478:141.

Petito Boyce, C., C.E. Evans, and R.A. Schoof. 1992. Impacts of recent developments in assessing toxicity and exposure on risk assessment for arsenic carcinogenicity. Toxicologist 12(1) Abstract 933:246.

Schoof, R.A., C. Petito Boyce, and S.G. Whittaker. 1992. Assessing the severity of carcinogenic health effects. Toxicologist 12(1) Abstract 290:94.

Schoof, R.A., and C.S. Baxter. 1982. Stimulation of murine splenic lymphocytes after skin painting with a tumor promoter. Toxicologist 2(1) Abstract 322:91.

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Dina Johnson
Senior Scientist

PROFESSIONAL PROFILE

Ms. Dina Johnson is a senior scientist with more than 12 years of experience assessing human health effects from exposures to chemicals and biological agents. She has managed numerous scientific investigations of environmental and health-based allegations in support of pending or active litigation matters on behalf of plaintiff/defense attorneys or insurance companies. Such matters have involved a wide range of exposure sources, agents of concern, and effects claims including: adverse health effects and/or diminution of property value due to moisture intrusion and mold contamination of residential and commercial buildings; adverse health effects in dozens of workers allegedly exposed to chemical warfare agent releases at a construction site; and a claim of cerebral palsy occurring in the offspring of a retail store employee allegedly due to workplace carbon monoxide exposure during her pregnancy. She routinely consults to insurance companies and attorneys to provide strategic scientific support and guidance regarding the validity of claims asserted and the overall strength of these claims based on the reliability and sufficiency of available exposure data, identification of alternative explanations for (or confounders to) claims alleged, and current state-of-the-science regarding alleged agents of concern.

Ms. Johnson has also managed and conducted numerous health risk evaluations of chemical and biological substances in various environmental media including air, soil/sediment, groundwater, and surface water. Ms. Johnson's human health risk assessment experience includes screening level, detailed, and multipathway analyses at a variety of manufacturing, processing, treatment, storage, and disposal sites, for both public and private sector clients.

CREDENTIALS AND PROFESSIONAL HONORS

B.A., Applied Ecology, University of California, 1991

Air & Waste Management Association

RELEVANT EXPERIENCE

Litigation Support – Mold Cases

Law Firm for Defense, Washington – Provided extensive, critical review of water intrusion and mold investigation data obtained by plaintiffs' experts at a low-income housing apartment complex in Washington State. Plaintiffs comprised multiple tenant families residing at the complex including adults, teens, and young children. Health related allegations included respiratory, dermatological, neurological, and gastrointestinal ailments. A detailed review of available medical records for each plaintiff was performed and evaluated along with site-specific investigation data and current scientific literature concerning the agents of concern to determine the strength of causal allegations on an individual plaintiff basis. Efforts contributed to favorable mediation outcome on behalf of defense regarding personal injury elements of the complaint.

Law Firm for Defense, Washington – Provided extensive, critical review of water intrusion and mold investigation data collected over multiple years at a newly constructed condominium in Washington State. The condominium owner/resident alleged exposures to mold contamination within the building caused her to develop asthma. A detailed review of medical records for plaintiff revealed pre-existing history of symptoms alleged, temporal inconsistencies not supportive of causality, and several alternative explanations/confounders to the alleged causality. Prepared report of findings concluding that alleged causality could not be established on a more probable than not basis given available exposure data, medical history, and current state-of-the-science regarding alleged agents of concern.

Law Firm for Defense, Washington – Provided extensive, critical review of water intrusion and mold investigation data collected over multiple years as part of ongoing indoor air quality remedial activities at a newly constructed elementary school in Washington State. The plaintiff, a teacher at the school, alleged adverse health effects associated with exposures to molds within the classroom. Also conducted a detailed review of plaintiff health history and medical records (pre- and post-occupancy). Provide key scientific support and guidance regarding the validity of claims asserted and the overall strength of these claims based on the reliability and sufficiency of available exposure data, identification of alternative explanations for (or confounders to) claims alleged, and current state-of-the-science regarding alleged agents of concern. Efforts contributed to favorable settlement by defense of health-related claims during mediation of case.

Law Firm for Defense, Washington – Critically reviewed plaintiff expert's mold investigation and assessment data and proposed remedial actions resulting from water intrusion events and subsequent mold growth in plaintiff's condominium residence. Participated as part of an expert technical team of defense and plaintiff representatives to refine scope of proposed remediation to appropriately address risks posed by the site and reasonably allay plaintiff concerns.

Law Firm for Plaintiff, Nebraska – Reviewed potential adverse health effects associated with exposure to airborne concentrations of pathogenic and toxigenic fungi present inside a Nebraska residence. Findings were evaluated in comparison to chronic health problems experienced by residents of the home. The indoor air contamination was believed to be the result of negligence on the part of a water damage repair company hired to restore the homeowner's basement carpeting after a flood.

Law Firm for Defense, Washington – Provided a critical review of mold investigation and assessment activities performed by an environmental testing consultant on behalf of plaintiffs alleging adverse health effects related to fungal exposure within their condominium. Examined the plaintiff expert's sampling methods, analytical techniques, and interpretation of findings contributing to summary judgment outcome in favor of defense.

Law Firm for Plaintiff, Washington – Provided litigation support on behalf of plaintiff alleging adverse health effects related to biological and chemical contamination of indoor air quality due to construction defects in their single-family residence. Critically evaluated prior sampling and analysis results obtained at the residence and assessed the likelihood of adverse health effects to plaintiff and family members based on available exposure data.

Law Firms for Defense, Washington – Retained in advance of health effects allegations on several construction defect litigation cases to provide early strategic input regarding the scope of microbial characterization needed and/or strength of existing data collected by plaintiffs. In some cases, also provided technical observation and review of investigation activities conducted onsite to document potential quality issues and data gaps in the context of data interpretation.

Litigation Support – Chemical Cases

Law Firm for Defense, Washington – Provided scientific support in a case involving allegations of exposure to chemical warfare agents by several dozen construction workers located in the vicinity of agent storage areas. Evaluated incident reports, medical histories, fate and transport data, and other physical evidence related to allegations to determine whether reported health effects were more probably than not resultant from the alleged exposures.

Law Firm for Plaintiff, Washington – Provided scientific support for plaintiffs, a family exposed over several years to an herbicide, dinoseb, via groundwater contaminated by neighboring source. Estimated exposure doses in context of individual ages and body weights at the time exposures occurred with consideration of specific consumption patterns related to contaminated source. Evaluated potential adverse outcomes based on review of current scientific literature for dinoseb.

Law Firm for Defense, Washington – Provided scientific support for a plaintiff exposed to a variety of chemicals while working at an aviation manufacturing facility. Evaluated potential for chemical exposures to result in alleged health effects and impact of pre-existing health status on overall severity of exposures.

Law Firm for Defense, Washington – Provided scientific support to evaluate validity of health related claims against a composting operation in the Pacific Northwest. Nearby residents were concerned that odors allegedly emanating from the facility represented a health hazard. Reviewed facility background, nature of odor complaints and alleged health effects, and toxicological literature to assess the potential for alleged emissions to cause adverse health effects to surrounding communities. Also evaluated potential contribution to odorous emissions by nearby landfill.

Law Firm for Plaintiff, Washington – Provided scientific support on behalf of plaintiff exposed to accidental chlorine release from a chemical manufacturer. Evaluated the potential for and nature of adverse health effects experienced by the plaintiff given the estimated exposure concentration and duration. Toxicological evaluation conducted in the context of the plaintiff as a potentially sensitive individual.

Law Firm for Plaintiff, Washington – Prepared a work plan to evaluate the potential for adverse health effects related to a microbial contamination in a private water supply. Complaint brought forth by residents of a mobile home park in a class action suit stemming from an overflow of untreated sewage. Proposed assessment included examination of exposure events, identification of microbial agents of concern (MAOC), and identification of possible health effects associated with direct and indirect contact with MAOC in sewage.

Law Firm for Plaintiff, Pennsylvania – Litigation support provided regarding human exposure to silane/siloxane based weather treating product applied to brickwork on the exterior of a private residence. Homeowners complained on adverse health effects due to odors entering interior of home.

Law Firm for Plaintiff, Washington – Litigation support services provided to assess probability of potential adverse health effects to residents living in the vicinity of a former lead smelting and refining operation. Elevated concentrations of lead in soils were evaluated for toxicological effects on residents, especially children. Study used to evaluate appropriate remedial alternatives for site area.

Law Firm for Defense, California – Provided litigation support evaluating effects of intra-uterine carbon monoxide exposure on fetal outcome. Assessed the scientific/toxicological basis for a correlation between the alleged exposure event and a diagnosis of cerebral palsy in an infant whose mother experienced carbon monoxide exposure at her workplace during pregnancy.

Chemical Manufacturing Company, California – Provided mediation support related to the allocation of cleanup costs at a toluene-contaminated site sold from one chemical manufacturer to another. Conducted fate and transport computer modeling and applied a regulatory-accepted soil attenuation factor methodology for the determination of potential impacts to groundwater as part of the overall cost allocation assessment.

Insurance Claim Investigations

State Farm Insurance Company, Washington—Managed scientific investigations of several indoor air quality claims involving potential mold exposures on behalf of State Farm Insurance Company. The investigations focused on assessing the validity and strength of claims asserted, including allegations of adverse health effects resulting from residential exposure to molds. Evaluations considered available exposure data, review of medical records, identification of alternative explanations for (or confounders to) claims alleged, and current state-of-the-science regarding alleged exposure agents.

Safeco Insurance Company, Washington—Managed scientific investigations of several indoor air quality claims involving potential mold exposures on behalf of Safeco Insurance Company. The investigations focused on assessing the validity and strength of claims asserted.

Multiple Insurance Companies, Washington—Managed scientific investigations of insurance claims related to mold contamination at single-family residential buildings. Investigations focused on assessing the validity and strength of claims asserted relative to alternative explanations and excluded coverage issues.

Cigna Insurance Company, California – Conducted a toxicological evaluation of xylenes, diethylene glycol monomethyl ether, and diethylene glycol monobutyl ether to verify claims of adverse health effects by movie theater patrons allegedly exposed to a mixture of cleaning chemicals while on the theater premises.

Multiple Indoor Air Quality Assessments, Washington – Provided senior technical review of mold-related building investigation closure reports for approximately 30 recently constructed residential units at multiple developments on behalf of the developer. Developer had proactively initiated investigations and corrective actions upon identification of common construction defects that could lead to conditions favorable to mold growth within building units.

Mold-Related Health Assessments, Washington – Consulted to various individual residents regarding concerns for potential health effects related to exposure to elevated concentrations of fungal species within their homes. Frequent organisms of interest include *Aspergillus, Penicillium* and *Stachybotrys.*

Toxicology and Risk Assessment

Brightwater Siting Project, Washington—In support of County site selection activities, conducted screening level and detailed human health risk assessment of recreational and fish consumption pathways for numerous chemicals at several possible municipal outfall locations within the Puget Sound.

Confidential Anthrax Assessment —Managed the development and implementation of sampling and analysis to determine whether Bacillus anthracis (anthrax) organisms could be detected at a military mail facility receiving mail from other facilities with confirmed contamination. Provided scientific interpretation of findings to assist in safe-guarding potential health threats to mail room workers.

Power Generating Companies, U.S. — Conducted human health risk assessment of toxic release inventory (TRI) air emissions from coal-fired electric generating stations in Texas, Michigan, and Illinois. Each of these projects was conducted to in order to place TRI reporting quantities data into a meaningful exposure context to more accurately portray potential risks to communities surrounding each facility.

Cement Manufacturing Facilities, Midwestern States — Conducted and reviewed multipathway health risk assessments of stack and fugitive emissions for cement kilns and hazardous waste incinerators in the Midwest. Chemicals of concern include dioxin and furans and 1,3-butadiene. Evaluated air modeled concentration and deposition data to determine risks to potential and existing receptors due to both direct (inhalation) and indirect (food chain) exposure pathways.

Food Processing Plants, California — Conducted air modeling and risk assessment of emissions for food processing facilities under California's AB2588 Air Toxics regulations.

Sugar Beet Processing Plants, Minnesota — In support of the Minnesota Pollution Control Agency's air toxics review process, qualitatively and quantitatively evaluated potential risks to ecological and human health receptors from stack and fugitive air emissions emanating from two sugar beet processing facilities.

Chemical Manufacturing Company, California — Provided critical review and oversight of a human health risk assessment of soils contamination at a solid waste management unit for a chemical manufacturing company. Evaluated methodological approach, key assumptions, and quality of toxicological benchmarks used in the risk assessment.

Risk Management and Prevention Programs (RMPPs), California – Prepared RMPPs, including participation in Hazard and Operability Studies (HAZOP studies) and implementation of air release and dispersion models (ISCST, DEGADIS, and ARCHIE), related to the storage and handling of acutely hazardous materials at water treatment facilities.

Clark County Sanitation District, Nevada – Evaluated human exposure to bioaerosols and CLARIFLOC® C-9525 POLYMER, a conditioning agent used to dewater sludge at an advanced wastewater treatment plant. Study focused on staff and their exposure to biological agents resulting from the operation of dewatering process.

Cellulose Insulation Manufacturer's Association, CA – Prepared a human health risk assessment for occupational exposure to cellulose insulation for a national cellulose manufacturers' association. Extensively reviewed toxicological literature for possible cancer and non-cancer hazards due to exposure to wood dust and chemicals resulting from paper production process and manufacture of insulation product. Study results presented to a California-OSHA Air Contaminants Advisory Committee evaluating adequacy of worker exposure standards.

State of California – Performed a Risk-Based Corrective Action Tier 1 screening of petroleum contamination related to UST and fuel dispensing activities at a state correctional camp located on state forest service property.

Semiconductor Facility, California – Conducted an assessment of risk related to petroleum contaminated soil present beneath an above-ground container storage area undergoing closure at a semiconductor facility.

U.S. Military Base Landfill, California – Conducted fate and transport modeling and risk assessment to determine allowable concentrations of petroleum-related compounds in foundation and cover soils to be emplaced on a landfill at a large military base.

Education and Public Outreach

U.S. Department of Energy, Washington – Developed training materials and participated as an instructor to nuclear process operations personnel undergoing certification at the U.S. Department of Energy's Hanford site in Richland, Washington.

U.S. Department of Energy, Washington – Developed training of site personnel for understanding compliance and public involvement activities associated with implementation of the Tri-Party Agreement between U.S. EPA, Washington Department of Ecology, and the U.S. Department of Energy.

Rio Vista Water Treatment Plant, California – Responsible for coordination and oversight of multiple subcontractors involved in developing a large-scale southern California water education and public awareness program in conjunction with a newly constructed, state-of-the-art water treatment facility. Elements of the program included educational signage, interactive computer work stations, a water conservation landscape exhibit, hands-on water treatment exhibits, and facility promotion.

Environmental and Regulatory Compliance

El Chorro Golf Course, California – Developed a waste minimization plan for agricultural chemical use at a newly- constructed golf course in accordance with California pollution prevention requirements.

U.S. Department of Defense, California – Prepared Environmental Protection Plans and developed Data Quality Objectives related to sampling and remediation activities conducted at two California-based DOD bases scheduled for closure.

U.S. Department of Energy, Washington – Responsible for assurance of compliance with environmental regulations, such as CERCLA, RCRA, and NEPA, within the context of the Hanford Federal Facility Agreement and Consent Order ("Tri-Party Agreement"). Regulatory compliance and negotiation covered a variety of U.S. Department of Energy programs including: Environmental Restoration, Spent Nuclear Fuel, and Facility Transition.

Various Water Companies, California – Provided regulatory interpretation of water resource and water quality issues related to obtaining, treating, and conveying water and wastewater in California.

Water/Wastewater Treatment Company, California – Provided permitting support to construction of large-scale water/wastewater treatment facilities and operations. Compliance support included siting/removal of underground storage tanks, emissions of acutely hazardous materials to air, utility installations, and easement approvals.

PRESENTATIONS

Belzer R.B., Johnson D., Peterson M.K., and Pleus R.C. 2002. Comparative Risk Assessment for Perchlorate: How does the U.S. EPA's RfD Compare to Other Goitrogens that are Found in the US Diet. Presented at the Society for Risk Analysis Annual Meeting: Symposium on Perchlorate: Policy Implications, New Orleans, LA, December 8-11.

Johnson D.L. 2003. Overview of Health Concerns by Occupants of Indoor Environments. Presentation to the Water Intrusion and Mold Claims Continuing Legal Education Seminar, Seattle, WA. July 10.

Johnson D.L. 2002. Understanding Mold-Related Health Effects. Presentation to the Seattle Chapter of Northwest Real Estate Appraisal Institute's workshop Understanding Mold Claims and Managing Risk Through Proper Investigation. September 18.

Johnson D.L. and Pleus R.C. 1998. Current Issues that Effect the Estimate of Cancer Risks and Non-cancer Hazards in Multipathway Risk Assessments for BIF Facilities. Air & Waste Management Association Annual Meeting, Specialty Conference, Boilers and Industrial Furnaces. April 15-16, Kansas City.

Peterson M.K., Bruce G.M., Johnson D.L., and Pleus R.C. 2001. Evaluation of Risks and Health Effects in Humans Exposed to the Herbicide Dinoseb: A Case Study. Poster presented at the 2001 Society for Risk Analysis Annual Meeting, Seattle, Washington, December 2-5.

Pleus R.C. and Johnson D.L. 1998. Assessing the Risks and Costs to Environmental Cases: Case Studies of Management Responses to Community Discontent. Air & Waste Management Association Annual Meeting, Specialty Conference, Boilers and Industrial Furnaces. April 15-16, Kansas City.

PUBLICATIONS

Johnson D.L. and Pleus R.C. 1998. Current Issues that Effect the Estimate of Cancer Risks and Non-cancer Hazards in Multipathway Risk Assessments for BIF Facilities. Waste Combustion in Boilers and Industrial Furnaces. Proceedings of a Specialty Conference Sponsored by Air & Waste Management Association.

Pleus R.C. and Johnson D.L. 1998. Assessing the Risks and Costs to Environmental Cases: Case Studies of Management Responses to Community Discontent. Waste Combustion in Boilers and Industrial Furnaces. Proceedings of a Specialty Conference Sponsored by Air & Waste Management Association.

EMC²

Resume
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EXPERTISE

Senior environmental professional with over 20 years of environmental, technical and financial management experience skilled in the implementation of cost-effective environmental remediation systems. Proficient in cost effective remedial design, regulatory agency negotiation in hazardous and solid waste management, evaluation and development of environmental remedies, including remedial investigations, feasibility studies, site investigations, remedial actions and Brownfields activities.

WORK EXPERIENCE

EMC ^{2} – Denver, Colorado
Principal

Strategic Environmental Management, LLC, Englewood, Co
Principal

Providing a broad range of environmental services specializing in assisting business enterprises in the assessment of environmental risk in merger, divestiture and acquisition opportunities and cost effectively remediating and managing environmentally impaired properties.

Developed the environmental criteria to be utilized in screening and prioritizing environmentally impaired properties presented for investment consideration to Brownfields Capital, a subsidiary of Affordable Residential Communities of Denver, Colorado.

Assisting Brownfields Capital in identifying sites, reviewing and assessing environmental and financial data and continue to support the underwriting process.

Currently representing the Mercantile Bancorp Limited of Vancouver, British Columbia, who have a secured interest in an environmentally impaired property in the Port of Tacoma, Washington, in their efforts to maximize value.

Cyprus Amax Minerals Company, Englewood, CO
Manager, Environmental Engineering

Led the financial and operational management of Cyprus' nation-wide remedial operations, providing technical direction and program management with a budget of $100 million on over 50 sites in 17 states.

Successfully negotiated and sold a CERCLA Superfund site to a joint venture land development company in Pennsylvania, thereby removing a $17 million liability from the balance sheet.

Significantly reduced the cost of remediating a former smelter site in Oklahoma from $60 million to $25 million by introducing scientific studies that supported a lower cost solution.

Convinced USEPA and the Michigan Department of Environmental Quality to change their published $20 million Record of Decision remedy to a $5 million remedial alternative.

Utilizing a well-practiced ability to achieve successful regulatory agency negotiation results, reduced a $3.8 million USEPA oversight charge to $1.7 million.

Negotiated a detailed contract for the removal of radioactive waste from a 23 acre site in Colorado that reduced the total remediation cost from $10 million to $2 million.

Cyprus Minerals Company, Englewood, CO
Manager of Reserve Acquisitions

Responsible for sourcing, evaluating, negotiating and recommending equity ownership in oil and gas reserves for Cyprus Power Corporation.

Acquired $800 million in reserves over a two-year period.

Negotiated with El Paso Natural Gas Pipeline for a five-year gas supply contract that reduced plant operating costs by 20%.

Home Petroleum Corporation, Denver, CO
General Manager of Engineering and Production

Directed the activities of the Reservoir Engineering and Production Operations Departments including the profitable operation of over 1,600 oil and gas wells in the Rocky Mountain, Mid-Continent and Gulf Coast areas.

Established and implemented a $30 million divestiture program that allowed the company to sell over 800 marginally economic wells over a three-year period at prices in excess of book value.

Instituted an operational cost cutting program that resulted in annual savings of $2 million.

Manager of Reservoir Engineering

Coordinated the activities of the Reservoir Engineering Department including reservoir evaluations, volumetric reserve studies and economic evaluation of potential exploration plays.

Developed an in-house reserve reporting system could be designed and implemented in time for the year-end deadline. The new system was completed on time and eliminated an annual $300,000 outside consultant fee.

Manager of Economics And Planning

Advised Senior Management on acquisitions, divestitures and capital investment opportunities.

Managed a 17 million barrel underground gas liquids storage facility, a gas liquids pipeline and 530 non-operated wells in the United States.

Returned an unprofitable underground gas liquids storage business to profitability during a period of shrinking demand by reorganizing and downsizing the operation to fit the market.

Designed and maintained a computerized financial long-range planning model that reflected the impact of operational changes on the corporate financial statement.

Home Oil Company, LTD., Calgary, Alberta, Canada
Coordinator of New Business Ventures & Planning

Evaluated the economic attractiveness and strategic importance of new business opportunities that resulted in the acquisition of Bridger Petroleum. Directed the activities of five staff members.

EDUCATION

University of Western Ontario, London, Ontario Canada
Bachelor of Engineering Science (Mechanical) 1973

University of Western Ontario, Richard Ivey School of Business
Master of Business Administration 1977

Appendix C

Sampling and Analysis Plan

Soil Sampling and Analysis Plan

This Sampling and Analysis Plan (SAP) describes the overall approach and methodologies to be applied to the sampling of soils from properties within the Town of Rico and those portions of immediately contiguous Residential Planned Unit Developments (RPUDs) to the east, south and west of the townsite that together constitute the Site. Specifically, this SAP discusses the investigation boundaries, sampling locations, sampling protocols, field procedures, and analytical procedures for the proposed sampling.

1.0 Investigation Boundaries

The investigation of soils will be limited to properties within the Town boundary and those portions of currently approved RPUDs immediately contiguous to the east, south and west of the current Town limits (see Figure 2 and Figure 3 in the main text). Emphasis will be given to residential, commercial, public, and open space (recreational) parcels in the existing developed portions of Town that may present a current unacceptable exposure to lead in soils (see Zone 1 on Figure 7 in the main text). Sampling will also be performed on properties within the Site that are available and/or currently planned for future development (see Zone 2 on Figure 7). The specific location and density of sampling in Zone 2 will be based upon the availability and quality of previous sampling data, the geology/mineralogy of the soils, and near-term future land use plans. Additional sampling of potential source material, Open Space/Public Facilities and Town streets within the Site will be performed relative to the associated exposure potential in accordance with the protocol for one of the other categories discussed here.

2.0 Types of Properties

The Town of Rico official zoning map (see Figure 3) identifies a number of different land uses, each of which presents its own considerations for exposure and abatement that must be assessed when formulating a sampling plan. Sampling of any property is subject to obtaining access from the landowner. The categories of properties and a summary of key considerations are as follows:

- <u>Residential</u> – These properties pose the most immediate potential for human exposure to lead in soils. For this reason, all residential properties (whether currently vacant and/or occupied or not) within the Town of Rico are targeted for sampling.
- <u>Commercial/Historic Commercial</u> – Such properties pose a potential for exposure, but the specific purpose and limited daily commercial use mitigates exposure. Such properties also present a lower likelihood of exposure to children. All commercial properties in Rico (whether currently vacant and/or occupied or not) are targeted for sampling to provide appropriate data for the health-based risk assessment.
- <u>Residential/Commercial Planned Unit Development (RPUD/CPUD)/Mixed Use</u> – These properties are less likely to pose an immediate potential for exposure, although future use of the property for the intended purpose could be of concern. Because future development activities (grading, excavating, etc.) may alter such properties, current sampling may not reflect the environmental condition at the time of development. These properties, both within the current Town limits and in contiguous portions of the RPUDs outside the Town limits, will be sampled as described in Section 3.0 to provide data to support the evaluation of the need for, and if necessary, the development of institutional controls (ICs).

- Open Space/Public Facilities – Properties of this type include rights-of-way, government buildings, schools, cemeteries, and common areas. Because these property uses vary widely, the sampling protocol will be developed on a site-by-site basis. For example, schools and common areas that may be frequented by children will be treated in a similar manner as existing residential properties; government buildings will be addressed similarly to commercial properties.

3.0 Soil Sampling Protocols

Soil sampling protocols have been developed for application to properties in currently developed portions of Town (soil sampling Zone 1) versus properties in areas of potential future development (soil sampling Zone 2). These areas may be refined based on more detailed review of property ownership and land use as part of detailed planning prior to initiating sampling. Note that any dispersed occupied residential or commercial properties that may fall outside of Zone 1 as defined on Figure 7 would still be sampled in accordance with the Zone 1 protocols below. As described below, the proposed sampling for the currently developed portions of Town (Zone 1) is at a higher overall density and includes surface sampling at all properties and depth sampling at a subset of the properties. These samples are intended to support development of the health-based risk assessment and any indicated Phase I or Phase II clean-up actions. Sampling of areas of potential future development (Zone 2) will involve surface sampling at a density appropriate to assess the general distribution of lead in soils in these areas and to support evaluation of the need for and development of ICs as appropriate. Additional sampling for source materials, open space/public facilities and Town streets would be conducted in accordance with the appropriate specific methodologies from either of the main protocols as described below.

3.1 Properties in Currently Developed Portions of Town (Zone 1)

3.1.1 Yard/Lot Composites

All yards/lots of existing residential and commercial properties will be sampled within the Town of Rico. Access agreements must be obtained from each property owner. The sampling approach to be taken at such properties is as follows. The property will first be divided into several sampling sections, depending upon the size of the parcel. For properties less than or equal to approximately 5,000 square feet, the property will be divided into two sections, typically distinguished by front yard and back yard. For properties greater than approximately 5,000 square feet, the property will be divided into four quadrants of approximately equal size.

Within each sampling section, surface soil samples will be collected from 0 to 1 inch at five randomly selected locations, not to include obvious potential source areas (e.g. – soil piles) or the drip zone of buildings (four feet from the edge of the building) to avoid potential lead paint issues. The five yard samples will be composited into a single sample for analysis.

Depth samples will be collected from a subset of existing residential and commercial properties at a frequency of approximately one location per three properties sampled. At properties identified for depth sampling, a location will be randomly selected on the property for sampling at depth intervals of 0 to 6 inches and 6 to 12 inches.

3.1.2 Earthen Driveway Composites

Surface soil samples will be collected from 0 to 1 inch at two randomly selected locations from each earthen driveway. These two samples will be composited into a single sample for analysis.

3.1.3 Garden Composites

Soil samples will be collected from each garden at a sample density of one sample per 100 square feet, with a minimum of two samples per garden. These samples will be composited into a single sample for analysis. Samples will be collected at a depth interval of 0 to 10 inches to reflect the typical tilling depth of gardens.

3.1.4 Play Areas Sampling

Additional samples will be collected in bare soil play areas in public/open space locations. For play areas less than or equal to approximately 2,500 square feet, surface soil samples will be collected from 0 to 1 inch at five randomly selected locations. These five samples will be composited into a single sample for analysis. An additional location within the play area will be randomly selected for sampling at depth intervals of 0 to 6 inches and 6 to 12 inches. For play areas greater than 2,500 square feet, the play area will be divided into two or more sections of area no greater than 2,500 square feet and the procedure will be applied to each section.

3.2 Properties in Areas of Potential Future Development (Zone 2)

Surface soil samples will be collected from areas within the Site as indicated on Figure 7 that are designated as RPUDs and CPUDs in the current Town of Rico Zoning Map and/or the Rico Master Plan (Figures 3 and 4, respectively). The purpose of these samples is to provide general information on lead distribution in areas available and currently approved for future residential or in-town commercial development and to support the development of possible future institutional controls (ICs). These samples will be taken at an average density of approximately one sample per 25 acres. Each sample will be comprised of a composited set of sub-samples collected from 0 to 1 inch depth at five randomly selected locations within each approximately 25-acre section. The 25-acre sample locations will be selected to ensure coverage of all of the currently approved and specifically identified RPUDs and CPUDs within the Site as shown on Figure 4, and at representative locations within other areas zoned for future residential or commercial development within the Site as identified on Figure 3.

3.3 Additional Sampling Locations

3.3.1 Potential Source Material

Any obvious potential areas of source material (soil piles, etc.) will be noted in field observations and sampled separately. Soil samples will be collected from each source material pile at an approximate sample density of one sub-sample per 100 to 1000 square feet depending on the size of the source area, with a minimum of two sub-samples per area. These sub-samples will be composited into a single sample for analysis. Sub-samples will be collected at a depth interval of 0 to 6 inches.

3.3.2 Open Space/Public Facilities Sampling

Properties in these categories may vary widely in use, from governmental buildings to playgrounds. Each of these properties will be reviewed relative to its exposure potential and will be appropriately placed in one of the other categories discussed herein, and sampled according to that particular methodology.

3.3.3 Town Streets

Surface soil samples of unpaved streets will be collected from 0 to 1 inch at two locations approximately equally spaced from the center of each block within the Town boundaries. These two samples will be composited into a single sample for analysis.

3.3.4 Sieved Samples

As a subset of soils sampled throughout the Town of Rico, twelve discrete surface (0-1 inch) soil samples and twelve discrete samples collected from depth (0-6 inches and 6-12 inches) will be selected from representative town locations for sieving prior to analysis. The soil to be analyzed will be collected from the sample portion passing through a No. 60 sieve. The sieved surface samples will be analyzed for *in vitro* bioaccessibility and lead using the methods described below. The sieved samples from depth will be analyzed for lead only.

4.0 Field Procedures

4.1 Access Agreements

A valid access agreement must be in place with the owner of the property prior to sampling.

4.2 Lot Maps

A scaled map of each property will be drawn by sampling personnel that shows property boundaries, house, garage, other structures, driveways, potential source material (e.g. – piles), lawns, major vegetation, and patios. The maps will be drawn in the field using available plat maps, measuring tapes and/or field portable GPS (as appropriate), and graph paper. All sampling locations will be documented using field portable GPS, and the locations and sample numbers will be recorded on these maps.

4.3 Field Documentation

All sampling activities will be recorded in field notebooks. After each subsample and sample is collected, it will be placed into a pre-labeled sample container. Each container will be sealed and labeled with the following information:

- Parcel identification (address and owner name)
- Sample number
- Sampling date and time
- Sampling personnel

A numbering system will be established for tracking each sample. The system will be designed to distinguish between types of properties and types of samples. Laboratory chain-of-custody forms will be prepared to ensure that the samples are traceable from the time of collection until final disposition.

Sampling locations and procedures will be photo-documented using either video or still photos. For still photographs, a log will be maintained that matches each photograph number with a written description of the photographic location. For video recording, a voice narrative will describe the location/activity being video recorded.

5.0 Analytical Procedures

5.1 Lead

Soil samples will be analyzed in the laboratory using x-ray fluorescence (XRF) spectroscopy. A subset of these samples will also be submitted for laboratory analysis using inductively coupled plasma (ICP) analysis. The proportion of samples that will be submitted for ICP analysis is preliminarily set at ten percent, but may be reduced to five percent if initial sampling establishes a strong correlation between the results of the two methods. In addition, for the 12 samples selected for sieving, both the sieved and non-sieved portions will be analyzed for lead by both XRF and ICP.

5.2 In vitro Bioaccessibility and Mineralogy

The relative oral bioavailability of lead will be determined in 12 soil samples collected from different areas of the Site. This determination will consist of two different types of testing: evaluation of lead mineralogy, and measurement of lead bioaccessibility using an *in vitro* extraction test.

Lead mineralogy analyses will be conducted using a JEOL 8600® electron microprobe to quantify the lead mass distribution in the mineral phases occurring in each of the 12 samples. This work will be conducted in accordance with a Standard Operating Procedure (SOP) developed by Dr. John Drexler at the Department of Geological Sciences, University of Colorado at Boulder. Measurement of lead bioaccessibility (i.e., the fraction that could become liberated in the human gastrointestinal tract, and be available for absorption) will be conducted by a qualified analytical laboratory according to the SOP developed by the Solubility/Bioavailability Research Consortium (SBRC).

6.0 Quality Assurance Procedures

More specific information on field and laboratory Standard Operating Procedures (SOPs), detection limits, quality assurance and quality control procedures will be provided in a Quality Assurance document to be submitted prior to field activities.